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Extracting a steel splinter from the eye of a workman.

POWERFUL ELECTROMAGNET FOR THE USE OF OCULISTS.—[See page 573.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Navy Yard Politics

TIME was when the navy yards of this country were dominated by the politician. During the last two decades they have gradually been emancipated from political interference; and, but for recently-enacted legislation, it would have been possible to say that the work of upbuilding of our navy, both at the yards and by private contract, was proceeding without let or hindrance. But, unfortunately, certain hasty and ill-considered legislation by Congress in 1910 and 1911, passed in the interests of navy yard labor, has so seriously handicapped the private shipbuilders, by whom, of necessity the larger part of our new ships must be constructed, as to discourage them from bidding upon government contracts; thus most seriously threatening the future development of that arm of the service upon which the United States must depend for its future security and permanence.

We refer to the eight-hour law, which renders it obligatory upon contractors for new ships to limit the hours of labor upon ships built for the government to eight hours a day.

The law of 1910 was extremely vicious and objectionable in its effect, and the 1911 law goes far beyond it, in that it is so indefinite in its terms that it is impossible to tell how it would be interpreted by the courts. Furthermore, failure to comply with it automatically stops all payments for the work in progress, leaving the contractor to face the probability of long and expensive litigation, with uncertainty as to the outcome, before he may or may not receive the contract price of the vessel. The present law, as it is written, is vicious as to form and indefinite as to terms.

In regarding the law in its broad economic aspects, there are many sides of the subject that should be considered. In the first place, the government is not passing a general law applicable to all of the material that it purchases; in fact, in the manufacture of these same ships that are to be built by eight-hour labor, all of the armor and a large part of the guns, the ammunition and the outfit, all of the electrical auxiliaries, the steel plates and shapes, and other parts entering into the vessel that are not built by the shipbuilders, will all be constructed without restriction as to hours of labor.

Nor is any attempt made to limit the hours of labor of the manufacturer of the shoes and other clothing for the army and the navy, the manufacturer of the paper and other supplies used in all of the departments of the government, or any one of the other general supplies; but shipbuilding is singled out as the one industry that shall be assaulted by the powers in Congress.

Every one of the large shipyards in this country is engaged both in merchant and naval work, and, most of them, in other lines of manufacture. It is everywhere recognized as a practical impossibility to run different hours on different jobs in the same plant. It is not possible to build a merchant ship on one slip, where all laboring men and mechanics are employed from seven to six, with an hour at noon; while on the slip next to it there is building a government ship, upon which the men work from eight to five, with an hour at noon; nor, in a machine shop, can one-half of the tools be started at seven, to work until six on merchant work, while the other half are started at eight to work until five on government work.

While it may be possible, by various subterfuges, to avoid the present wording of the law, this would merely mean a change, when the next naval appropriation act is written, to more closely tie the hands of the contractor; with the ultimate result of either forcing him to entirely abandon government work, or to place all of the work in his yard on an eight-hour basis. Let us observe the results of these two contingencies.

If government work is abandoned, he is then no longer restricted by the requirements of any law that may be passed; but he has given up what is to every large shipbuilder in this country so important a percentage of his business as to render his very existence uncertain, and the effect might be to oblige many of the shipyards to close their gates. This would mean that all naval work must be done at navy yards, a consummation most thoroughly in accord with the desire of the large group of navy-yard-labor politicians. This, however, would result in an increased cost of the ships of our navy of not less than forty per cent, as is clearly shown in the case of the "Florida," which has cost for direct labor and material nearly $6,400,000, as against the purchase price of the sister vessel, the "Utah," built by private contract, of about $4,000,000.

If, on the other hand, the shipyards accept the second contingency and proceed on a strictly eight-hour basis, they are then at a great disadvantage in their competition for other than government work. In all of the shops where tools are worked, the decrease in production due to the shorter hours will be directly in the proportion to the time, or a decrease of twenty-five per cent: while the wages of the men will unquestionably (as every manufacturer of experience knows) be increased, so that their yearly income will be unchanged—a further burden on the cost of production of twenty-five per cent. In other parts of the works, where labor is of a different character, by working piece-work prices, it is probable that the production in eight hours can be brought up nearly to the standard of ten hours; but the ultimate result will be an increase in the cost of the labor entering into the production of by twenty-five to ten per cent, according to the character of the work. How much this means in merchant work or repairs, or in the miscellaneous work done by practically all of the shipbuilders in competition with other manufacturers, needs no careful argument to explain.

Where the government is concerned, it will mean, as it already has in the case of the "Texas," a very considerable increase in the contract price, and this, in effect will amount to a direct *subsidy* to labor by a government that has repeatedly rejected the subsidy idea when applied to helping the shipbuilding and shipowning industries of the country.

While many other arguments may be urged, we believe that the above outlines the principal ones that should be kept clearly in view in the consideration of the present anomalous condition, in which Congress singles out one particular industry, struggling with unremunerative conditions, and harasses and burdens it with the effects of an indefinite and ill-designed law, applicable only to work done for the government; while at the same time it passes by the greater and stronger industries of the country, which supply yearly to the government, directly or indirectly, many times more in value than do the shipbuilders. As matters now stand, both parties in Congress willingly subsidize labor on shore to the amount of $5,000,000 annually, but steadily refuse to subsidize labor working on the high seas a single penny.

A Ray of Light in the Darkest Province of Chemistry

WE have in our day a vast army of trained scientific workers, and methods of research have been so far standardized that practically any man of sound intellect and reasonable dexterity can turn out original work, provided he receives the right training and possesses the requisite determination and perseverance. But while there is thus going on a general filling out of the gaps in the existing network of our knowledge, it is given to comparatively few to do something far more than this, to open up an entire new field along an untrodden path, by methods specially devised for the purpose. It is such achievements as this which distinguish the great dominant spirits of science, the Newtons, the Maxwells, and Pasteurs. The works of such men, as we look into the past, stand out like milestones along the avenue of the progress of science through the ages.

In such a retrospect men and events appear naturally in their right perspective. It is somewhat more difficult to gage correctly contemporary investigators and results. Yet we would hardly hesitate to point to Sir J. J. Thomson, of the Cavendish Laboratory, Cambridge, England, as a man whose name will stand on the records of the history of science side by side with the greatest lights of the past. For his work far overtowers that of most of his contemporaries, through the wealth of entirely new and fruitful concepts which he has introduced into modern science by ingenious experiment and astute analytical and synthetic reasoning. It is thus that he has given us an entirely new horizon by his work on the corpuscular structure of the atom, which not only seems to reveal to us the true nature of one of the most recondite forces inherent in matter—chemical affinity—but which links into harmonious union such fundamental natural phenomena as the mass-inertia of matter and the self-inductive inertia of an electric charge.

The latest product of the fertile mind of this great genius seems destined to throw light on the darkest chapter in the field of modern chemistry. We have hitherto rested content with the study of chemical substances in that state in which we find them either before or after a reaction has taken place. To ask, what is the nature of matter during the intermediate stages of the process of chemical transformation, would until recently have been regarded almost as an impertinent question, except perhaps when it came from the lips of such an eminent chemist as Schönbein. Yet it is this question which, among others, Sir J. J. Thomson seems to have found the means of attacking by direct experiment. By measurements of the deflection of positive rays in a vacuum tube containing traces of various substances, it is possible not only to identify the elements and compounds present, but at the same time to determine their atomic and molecular weight. Furthermore, since the rays are registered within less than a millionth of a second after their formation, if chemical action is going on in the tube, it is to be expected that the method should disclose transient forms of matter intermediate between two chemical compounds, and thus shed light on the true nature of the process of chemical combination. And experiment bears out this expectation. In a tube originally charged with marsh gas, Sir J. J. Thomson has detected products of molecular weight 12, 13, 14, 15, and 16, corresponding to molecules having one, two, three, and four hydrogen atoms attached to the carbon atom. These represent the several intermediate stages in the formation of the complete marsh gas molecule, and we have here the first positive observation of such half-formed molecules.

It is probably not too much to say that these experiments, of which an illustrated note appears on another page of this issue, usher in a new era in the history of chemistry.

A Record Rainstorm in the Philippines

THREE great typhoons occurred in or near the Philippines last summer within a period of three weeks, viz., July 11th-17th; July 20th-27th, and July 30th-August 2nd.

The maximum rainfall occurred at Baguio—the official health resort of the Philippines. This place is 4,777 feet above sea-level and is normally one of the wettest spots in the islands, with an annual rainfall of 157.52 inches. Never before, however, had such a torrential downpour occurred here as on the four days July 14th-17th, 1911. The daily amounts, as recorded by a self-registering gage, were: 14th, 34.64 inches; 15th, 28.88 inches; 16th, 16.73 inches; 17th, 7.89 inches—a total for the four days of 88.14 inches!

For a period of four days this record had rarely been equaled in the history of meteorology. In average intensity, however, this storm does not quite equal one that occurred at Cherrapunji, in the Khasi hills of India—a place well known to meteorologists as the wettest spot in the whole world. Here during the five days June 12th-16th, 1876, fell a total of 114.14 inches of rain, distributed as follows: 12th, 30.45; 13th, 7.75; 14th, 40.80; 15th, 22.84; 16th, 12.30. It so happened that the maximum in *four* days was a little less than Baguio's record for a like period, viz., 83.69 inches.

Both these records were, however, eclipsed by that of a rainstorm that occurred in the mountains of eastern Jamaica, in November, 1909. At a place called Silver Hill the fall—if correctly measured—amounted to 135 inches in eight days, of which 114.50 fell in five days; 96.50 in four days, and 57.50 in two days. That these figures are at least approximately correct is shown by the records of surrounding stations.

Sir Joseph John Thomson, the Great English Physicist

The Originator of the Corpuscular Theory of Matter

By P. Phillips, D.Sc., B.A., Professor of Physics at the Royal Veterinary College, London

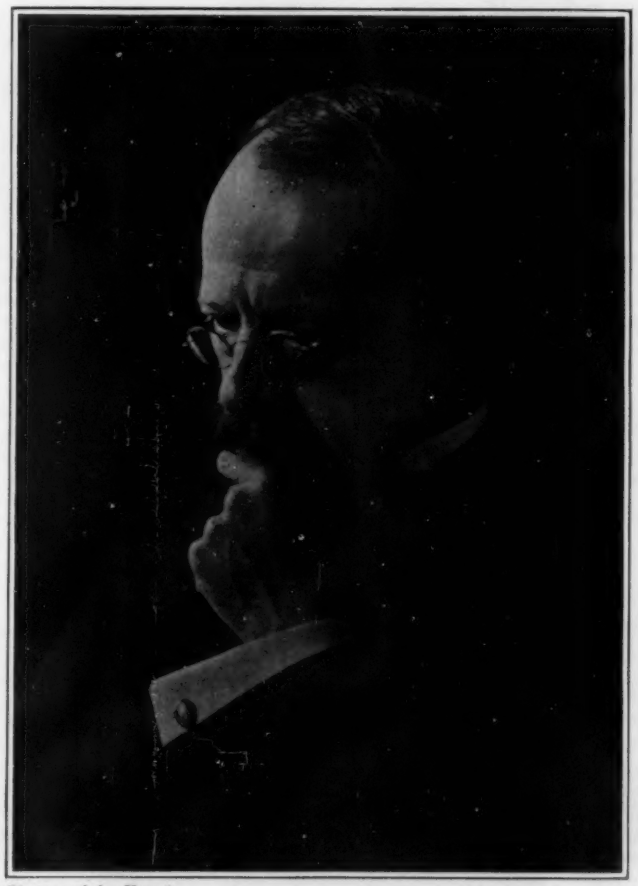
THE Cavendish Professorship at the University of Cambridge, England, of which Sir J. J. Thomson is the present holder, is a post of honor to which his predecessors have lent no ordinary luster. The first holder of the office was James Clerk Maxwell, the profound original genius who laid the foundations for the modern electro-magnetic theory associated with his name. The second Cavendish Professor was Lord Rayleigh, whose measurements of the fundamental quantities of physics are among the most beautiful and accurate experiments ever performed. The third to be called to the chair was Sir J. J. Thomson, who has proved himself in every way worthy of his predecessors.

He was appointed while a young man in his twenty-seventh year—a very early age for so responsible a position—and his appointment was severely criticised by some of the older and more orthodox professors and tutors. One well-known college tutor expressed the opinion that things had come to a pretty pass in the University when mere boys were made professors. But the Board of Electors, including Sir William Thomson (Lord Kelvin), Prof. G. G. Stokes, and Prof. G. H. Darwin, knew what it was doing, and the bold appointment has been amply justified by the continued advance of the Cavendish Laboratory and by the position which Sir Joseph has attained among his contemporaries.

His early training Sir J. J. Thomson received at Owen's College, Manchester, where he was a student in 1876, and carried out some experimental work under Prof. Balfour Stewart. He thence proceeded to Cambridge, where he read mathematics until taking his tripos in 1880. From this time dates his connection with the Cavendish Laboratory, which was later to become so intimate and prolonged. He was appointed to his present position in 1884. Perhaps when the lapse of time shall enable us to see things in a truer perspective, we shall consider that his greatest service to science has been the building up and inspiring of the center of research at the Cavendish Laboratory. When he was first appointed there were not more than seven or eight students engaged in research, while at the present time the number has risen to about thirty, and the mass of work emanating from this scientific center is a splendid testimony to the enthusiasm and ability of the men gathered there.

To give an account of any great man's work within the limits of a short article is always difficult, but it is unusually so in the present case, for Sir J. J. Thomson is so continually overflowing with ideas, that his contributions to science are extremely varied and numerous. It must suffice here to mention only a few of the larger pieces of work which he has carried out. In 1881 appeared as the Adams Prize Essay a mathematical treatise on the vortex theory. At that time the theory that atoms were vortices in the ether was very popular and several well-known names were connected with it; it had very little to recommend it, however, and since a better understanding of the phenomenon of the discharge of electricity through gases has given us more intimate information about the atom, the vortex theory has lapsed into a well deserved obscurity. Nevertheless the treatise formed a most valuable contribution to the general theory of vortices and showed some of the serious difficulties which would have to be overcome before the vortex theory of the atom could be accepted. Appropriately enough, one of Sir J. J. Thomson's earliest experiments was the repetition of a measurement which strongly supported Maxwell's electro-magnetic theory, namely, the determination of the ratio of the electro-static to the electro-magnetic unit of electricity. This was found to be equal to 3×10^{10}, a figure closely agreeing with the measured velocity of light expressed in centimeters per second. This result is one of the conclusions which Maxwell derived from his theory, which thus received strong corroborative evidence. Further confirmation was furnished in 1887 by the brilliant work of Hertz in demonstrating the existence of the electro-magnetic waves which Maxwell's theory foretold, and since then these waves have become a matter of every day talk by the development of wireless telegraphy. The next important work published by Sir J. J. Thomson was a series of papers published in the Philosophical Transactions of the Royal Society in 1886-1887 (and republished in book form in 1888) on "The Application of Dynamics to Physics and Chemistry." This work suggests a number of general methods of attacking chemical and physical problems which have proved most useful. Their greatest value lies in the fact that they can be applied even where very little is known of the inner processes going on.

A very important experiment was carried out in 1889, when Sir J. J. Thomson devised a method of finding the specific inductive capacity of different substances for very rapidly alternating electric forces. This experiment was of considerable interest owing to the fact that Maxwell's calculations of the velocity of light in different substances, as dependent upon their specific inductive capacity, gave results considerably at variance with the observed values in certain cases. Sir J. J. Thomson suggested that the discrepancy might be due to the fact that the specific inductive capacity of a substance for rapidly alternating electric forces, such as occur in light waves, differed from that found for steady electric forces in the usual way. Experiment completely bore out this suggestion, and added one more link to the chain of evidence in support of Maxwell's theory.



Photograph by Hoppé.

SIR JOSEPH JOHN THOMSON

After this followed a long series of experiments on the conduction of electricity through gases, which, along with the work of Schuster and others, has gone far to clear up our understanding of the mechanism of this complicated phenomenon. In 1898 these experiments culminated in the discovery of the "electron," or as Sir J. J. Thomson himself calls it, the "corpuscle." This discovery has ushered in a new era in science, and has opened out a vast realm for new work upon the development of which some of the great physicists and mathematicians of the day have spent their best efforts. It is unfortunately quite impossible within the scope of this article to give even a remote idea of the bearing of this work; only one or two points shall be mentioned with which the name of J. J. Thomson himself is associated. The picture of the atom which Sir Joseph would present to us is that of a large number of corpuscles, assembled together into a minute planetary system, in which the corpuscles play the role of planets, revolving in concentric rings. From considerations of the stability of such rings he has suggested an explanation of the existence of series or groups of elements with similar properties, thereby taking the first step in lifting the veil from the mystery of Mendeléeff's Periodic Table of the Elements. Furthermore, by calculating the period of vibration resulting from various distortions of such rings of corpuscles, he has also suggested an explanation for the existence of series of lines in the spectra of different elements. Since this conception of the atom was first put forward by Sir J. J. Thomson, it has been found that some elements are continually breaking down, ejecting corpuscles, and giving rise to other elements as transformation products.

Had the old idea of the indivisible atom still remained, this would have presented an almost insoluble problem, but with the new view of the atom it becomes perfectly simple. Breaking down the atom is simply knocking off some of the outer rings of corpuscles, leaving the inner rings intact, and it is evident that such a process must be accompanied by the ejection of corpuscles unless the rings which are knocked off reform themselves into a new system with exactly the same number of corpuscles as are broken off the parent atom.

Since that time Sir J. J. Thomson's main experimental and theoretical work has been concerned with the further working out of the problems presented by the conduction of electricity through gases, and with the constitution of the atom, but space does not permit of the presentation of his work in further detail.

As a teacher he exerts a most inspiring influence upon his students, making himself one with them, and making them feel that he and they are engaged upon a common quest. This sympathy with his pupils is probably the secret of his power, but he has other qualities which are very valuable to his students. His happy way of working things up from first priaciples, and thus recalling the strong and weak points in any theory, is most suggestive, clears up a man's ideas, and is most excellent preparation for future research work. To observe his use of mathematics is an education in itself. Sir J. J. Thomson is never led away into those pretty mathematical bypaths so dear to the heart of the orthodox Cambridge mathematical physicist. He selects such mathematics as is required for his investigation and then marches straight ahead for his goal in a most convincing fashion. He is always the physicist first and the mathematician after. As leader of the research students at the Cavendish Laboratory Sir Joseph is the most approachable and helpful of men. Although his personality dominates the laboratory, yet there is splendid freedom from restraint and a wonderful encouragement to carry out research on any subject. His visits to any particular student may be somewhat spasmodic, but this is quite in keeping with some other little eccentricities which are well known to all his students and which no doubt lose nothing in the telling. At tea, which he provides every afternoon in his room for all the research students, J. J., as he is always called, is perhaps at his best. At this time all the gossip of the laboratory passes around and a story has to be a pretty tall one if he does not manage to cap it. J. J.'s vigorous radical utterances are also very warmly discussed, and not infrequently, among the cosmopolitan collection of students, the political discussions become both interesting and very animated.

In this article the endeavor has been simply to show Sir J. J. Thomson as a man of science and the head of a famous laboratory. Of the many honors showered upon him, culminating in the award of the Nobel prize in 1906, and the bestowal of Knighthood in 1908, and of his home life, nothing has been said; but the writer hopes that enough has been laid down to make the reader join him in the wish that J. J. may be long spared to extend the limits of our knowledge in that section of natural science which he has made peculiarly his own, and in which he has labored with such brilliant success, giving to the world the priceless gift of his genius, and earning imperishable fame.

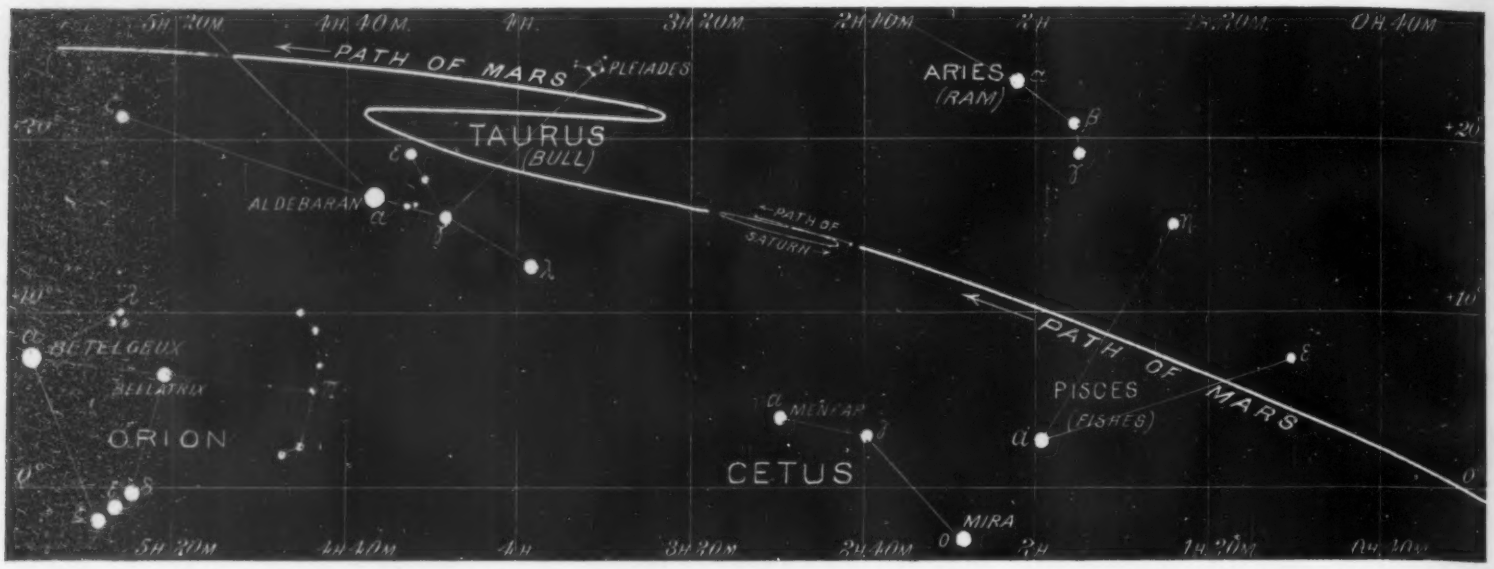


Chart showing the travel of Mars and Saturn across the heavens during equal periods of time, from June 1st, 1911, to March 31st, 1912.

The Motions of Mars and Saturn

Apparent Meanders of Two "Wandering Stars"

By Prof. S. A. Mitchell, Columbia University

IT needs but a casual glance to see that Mars is now the brightest object in the evening skies, it needs but a few evenings' watch, even for anyone not acquainted with the stars, to note that Mars is a "wandering star," as the Greeks called it, a planet. By making a diagram giving the position of Mars with respect to the neighboring stars, it will be easily seen, after a few nights' watching, that Mars is now moving toward the west among the stars. The first week in December found Mars due south of the Pleiades and but a few degrees away from them. It continues to move west only until the 29th of December, when it ceases its westward motion, becomes stationary, and then moves east at first slowly, and then with increasing pace.

To the west of Mars is Saturn, the wonderful, a never-ending source of pleasure to the amateur with his small telescope. It, too, is changing its position among the stars, but with a stateller mien owing to its increased distance from us. Saturn, too, at the present time, is moving toward the west, but it keeps on moving west until after the middle of January, 1912, when it becomes stationary, and then moves also to the east.

The amateur who likes to watch the sky will find a great deal of profit from noting the motions of these two planets' relation to the stars. The accompanying diagrain shows the motion of Mars from June 1st to March 31st, and that of Saturn for the same interval, from the first of January to the end of March. A glance will show that Mars "retrograded," or moved to the west from October 17th to December 19th, while Saturn moved backward on its path for a longer time, but through less angle, from 1911, September 2nd. to 1912, January 16th. Another glance will show that Mars has three times passed by the Pleiades: first, at the end of August, when it was six degrees to the south of them; for the second time during the first week in December. Toward the end of January will occur the closest of all three approaches, when it again passes to the south. By following the diagram backwards, it will be seen that on August 15th, Mars and Saturn were very close together. As a matter of fact on August 16th at 11 P. M., Mars and Saturn were separated by only twenty-one minutes of arc, which is an angle equal to two-thirds of the moon's diameter, Mars being north of Saturn. On the same night, a few hours later, the moon was in the same part of the sky, passing to the north but four degrees away. This interesting conjunction has been magnificently portrayed by the accompanying photograph taken with the six-inch Bruce telescope by Prof. E. E. Barnard of the Yerkes Observatory. This was taken on the morning of August 17th at 3:14 o'clock with an exposure lasting twenty seconds. It is a remarkable photograph in that it shows the dark portion of the moon in the last quarter illuminated by "earth shine." The planet nearest the moon is Mars.

After the date of this photograph, Mars was moving rapidly eastward while Saturn soon slowed down and then moved westward. By October 17th, the planets were separated by 25 degrees, when the change in the motion of Mars again began to lessen the distance. They will be nearest each other about New Year's, after which the eastward motion of Mars will again cause the distance to increase.

As everyone knows, the apparent motion of the planets is caused by the motion of the planet about the sun combined with that of the earth. The relative motion of Mars, for instance, may be correctly represented by supposing that it has two motions, one its own motion, and superposed on this another, equal in magnitude to that of the earth's motion about the sun, but in the opposite direction. This simple fact explained in detail in every text book on astronomy need not further be elaborated here.

Photo. by E. E. Barnard.

Conjunction of Mars, Saturn, and the Moon, 1911, August 16, 15h. 14m. C. S. T.

A Type of High-intensity Primary Cell

By Dr. Alfred Gradenwitz.

A NEW high-intensity primary cell invented by H. D. P. Huizer of The Hague owes its high efficiency mainly to the fact that the carbon and zinc are located as closely to each other as possible, the carbon having a grooved surface through which the ions can be discharged easily and rapidly. Wherever these ions after their discharge result in polarization, the apparatus is so designed as to produce immediate depolarization by chemical and mechanical effects, so that the ions coming afterward may be free to discharge on the poles. The high current density and short distance between the carbon and zinc also warrants a uniform and economical dissolution of the metal. At a recent test the electromotive force in open circuit was found to be about 1.95 volts and the working tension with weak currents (up to 1 ampere [0.065 per square inch] per square decimeter electrode surface) about 1.8 volts, with high-intensity currents (up to 5 amperes [0.32] per square inch) about 1.6 volts and with maximum current densities (up to 0.65 amperes per square inch) about 1.4 volts. Current rushes and even short-circuits (up to about 2 amperes per square inch) with tensions reduced in proportion, were found to exert no objectionable action on the cell; the internal resistance was very low (down to 0.01 ohm).

Ten incandescent lamps of a total of 26-27 candlepower could be fed permanently with a single cell. The consumption of zinc with diluted sulphuric acid was found to be 1.7 grammes per ampere-hour (the theoretical electro-chemical equivalent being, of course, 1.22 grammes per ampere-hour). The useful current effect was found to be 70 per cent, so that 1 kilogramme of zinc (and 1½ kilogrammes of sulphuric acid) will be amply sufficient to develop 1 horse-power-hour, the current expenses only being about 16 cents, viz., 1/10 of that of ordinary primary cells. The depolarizing capacity is so remarkable that one-fourth minute suffices for the cell to recover its maximum tension after a short-circuit.

It will be readily understood that these results constitute a remarkable advance over primary cells so far in general use. While the output of common stationary storage battery cells for each kilogramme of their own weight is 10-15 watt-hours and that of the portable accumulators 25-30 watt-hours, the new cells allow outputs of 30-50 and those designed for transportation operation as much as 100 watt-hours. In connection with a special type of cell the inventor is even able to insure 200 watt-hours for each kilogramme of cell weight.

In a test of an electric vehicle equipped with the new cells the current expenses worked out at about 3 cents per ton mile. With a single supply of zincs (about 330 pounds) and several re-fillings of acid, the vehicle covered a distance equal to that between the Hague and Paris (about 300 miles) at an average speed of 18 miles per hour. The new cell would moreover seem to lend itself to the propulsion of electric cars and airships.

The new cell is made in two different types. In connection with the tests described above concentric cylinders were used. However, in order even further to reduce the consumption of zinc, a special type of "parallel" cell has been designed in which the carbon surface is likewise increased to a maximum by ribs, though not in the shape of cylinders but of flat plates. The zinc, so far from constituting a homogeneous mass, assumes the form of minute disks performing an automatic motion by which their distance from the carbon is kept constant, insuring a uniform wear.

Powerful Electromagnet for the Use of Oculists

A Convenient Form of Apparatus for Extracting Iron and Steel Splinters

By C. Van Langendonck

THE electromagnet designed for the use of oculists by Dr. Haab, director of the Zurich eye clinic, and shown in the accompanying photographs, is the most powerful and efficient apparatus of this kind in existence. According to Dr. Haab, the principal requirements of such an instrument are the following:

1. The magnet must be capable of developing very great tractive force.

2. It must be placed horizontally, and its circuit must be made and broken by the operation of a pedal.

3. The working pole must have a form adapted to its peculiar function and its dimensions must bear the proper relation to those of the coil.

The first condition is very important. The small electromagnets which are commonly used by oculists often fail at the critical moment, owing to their lack of adequate magnetic strength, and thus endanger the success of the operation.

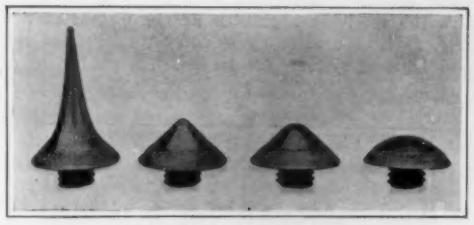
The method of making and breaking the circuit by the foot of the operator possesses great advantages, because it leaves both hands free for the control of the eye and body of the patient, and makes it unnecessary to remove the magnet in order to stop its action. This last point is exceedingly important for, even with the most perfect suspension, it would be impossible to withdraw the heavy electromagnet from the eye quickly enough to prevent the iron filing or other foreign substance from being drawn into a region where its presence is not desired. When the circuit is opened and closed by a pedal the magnet need not be suspended.

Dr. Haab regards the suspension method not only as impracticable for the heavy magnets which he employs, but as incorrect in principle. His experience proves that it suffices to support the magnet in such a manner that its axis can be turned to any direction in a horizontal plane.

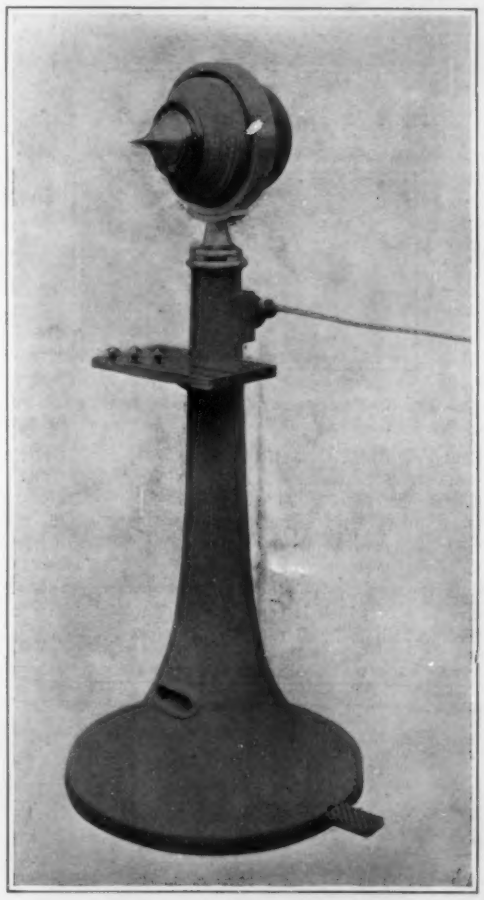
In regard to the form of the working pole, it is obvious that its action will be weakened in proportion to the extent to which it protrudes from the coil. It must not, however, be so short that the coil interferes with the view of the field of operation, as is the case in some of the newer large electromagnets.

The magnet is of the bell form. The working pole is a cone of 90 degrees, and this end of the coil is tapered sufficiently to give the operator a clear view of the field up to the tip of the magnet pole. Four pointed tips accompany each apparatus.

The idle pole is expanded into the form of a bell which covers and protects the greater part of the coil. This construction possesses the additional advantage of restricting the escape of lines of force to one side and diminishing the area of the external magnetic field.



A set of pole points.



Foot-controlled electromagnet.

The magnet is mounted on a cast iron pillar, in such a manner that it can easily be turned in any direction. The pillar is hollow and is provided with castors, so that the apparatus can be moved without difficulty. The axis of the magnet is about four feet above the floor. At a little more than half this height a shelf is attached to the pillar for the purpose of supporting the patient's arms and keeping his head motionless during the operation.

The base of the pillar contains the electric switch which is closed by depressing a pedal and is thrown open by a spring the instant the foot is raised. A special device protects the contacts from injurious sparking. The current-density in the coil is very small in comparison with its density in other electromagnets. Hence very little heat is developed—a condition essential to permanent efficiency.

In tractive power Haab's electromagnet stands at the head of all known electromagnets used by oculists. At a distance of 1.2 inches, for example, it exerts a pull more than twice as strong as that of the largest Volkmann magnet.

The electromagnet is designed for use on direct current circuits of 60 to 300 volts, but it can be employed on alternating uniphase or triphase circuits, with the aid of a suitable transformer. The maximum power required is about one kilowatt. The total weight of the apparatus is about 286 pounds.

This apparatus, although designed primarily for the use of oculists, is admirably well adapted for the extraction of iron filings and splinters, hammer-scale, etc., from wounds in any part of the body. Hence it may advantageously be installed in the hospital rooms of all large mining and metallurgical establishments. Experience shows that the magnets now employed in these rooms are used as often on hands and arms as on eyes. Wounds incurred in planing iron are often filled with fine splinters of iron. The removal of these splinters singly with pincers or needles is a tedious and painful operation, but all of the iron or steel particles can be extracted quickly by means of a powerful magnet.

A Seismograph in a Coal Mine

NATURE states that a seismograph has recently been installed in the Tunnel Colliery, at Nuneaton, for the purpose of ascertaining whether the apparently inexplicable falls of coal and roof in mines have any relation with the occurrence of earthquakes. Aside from the practical object in view, a comparison between the records of this instrument and those of instruments on the surface is likely to be of much scientific interest.

Frost Fairs on the Thames

LONDON winters are more remarkable for dismal drizzling rain and impenetrable fog than for snow and ice; but about half a dozen times in the last three hundred years truly arctic conditions have prevailed in that metropolis, and the River Thames has been frozen over so firmly that men and horses could go upon it. Each of these periods has been the occasion of a "frost fair"; booths have been erected on the ice; printing presses set up, various sports and games indulged in; and the whole population has joined in celebrating the rare event.

The first great frost fair was held in January, 1608; but the most famous of all was that of 1683-4, which lasted from the beginning of December to the 5th of February. Evelyn gives the following description of this fair in his "Diary": "The frost continuing more and more severe, the Thames before London was still planted with boothes in formal streetes, all sorts of trades and shops furnish'd and full of commodities, even to a printing presse, where the people and ladyes tooke a fancy to have their names printed, and the day and yeare set down when printed on the Thames: this humour tooke so universally, that 'twas estimated the printer gain'd £5 a day, for printing a line onely, at sixpence a name, besides what he got by ballads, etc. Coaches plied from Westminster to the Temple, and from several other staires, to and fro, as in the streetes, sleds sliding on skeetes, a bull-baiting, horse and coach races, puppet-plays, and interludes, cookes, tipling, so that it seem'd to be a bacchanalian triumph, or carnival on the water." King Charles II. and his family visited the fair, and had their names printed on a quarto sheet of Dutch paper, which is still extant.

During the frost fair of January, 1716, it is recorded that an uncommonly high spring tide, which overflowed cellars on the banks of the river, raised the ice fully fourteen feet, without interrupting the people in their pursuits.

Similar fairs were held in 1740, 1788-9, and 1814. The last was one of the gayest and most animated of these events, though it lasted only four days.

Meeting of the American Association

THE sixty-third meeting of the American Association for the Advancement of Science will be held in Washington, December 27th to 30th, 1911, under the presidency of Prof. Charles E. Bessey, of the University of Nebraska. In conjunction therewith will be held the tenth of the "convocation week" meetings of affiliated societies, viz.: American Anthropological Association, Astronomical and Astrophysical Society of America, Society of American Bacteriologists, American Society of Biological Chemists, Botanical Society of America, American Chemical Society, American Civic Alliance, American Economic Association, American Association of Economic Entomologists, Entomological Society of America, American Fern Society, American Folk-Lore Society, Association of American Geographers, Geological Society of America, American Federation of Teachers of the Mathematical and the Natural Sciences, American Home Economics Association, Society for Horticultural Science, American Association for Labor Legislation, American Microscopical Society, American Nature-Study Society, Paleontological Society of America, American Physical Society, American Physiological Society, American Phytopathological Society, American Psychological Association, Sigma Xi, American Sociological Association, American Statistical Association, Sullivant Moss Society, Southern Society for Philosophy and Psychology.

The administrative headquarters of the meeting will be at the New Willard Hotel, where all members will register, beginning at 9 o'clock, December 27th. The opening general session of the Association will be held at the U. S. National Museum at 8 P. M., December 27th. It is expected that an address of welcome will be given by the President of the United States, and the retiring president of the Association, Dr. A. A. Michaelson, will give his annual address, the subject being "Recent Progress in Spectroscopic Methods." The various sectional meetings begin at 10 A. M., December 27th. The programme of entertainments includes an exhibition cavalry drill at Ft. Myer, on the afternoon of December 28th, and an informal reception at the Corcoran Art Gallery the same evening.

The Australian Antarctic Expedition

DR. MAWSON'S projected antarctic expedition has secured a suitable vessel—the "Aurora," built at Dundee in 1876—and the preparations are proceeding rapidly. As we have previously stated, the object of this expedition is the thorough exploration of a portion of Antarctica, rather than a dash for the pole. It is announced that an aeroplane forms part of the equipment.

The Scientific American-Gould Prize

A COPY of the rules governing the competition for the flying machine prize of $15,000 offered by Mr. Edwin Gould under the auspices of the SCIENTIFIC AMERICAN will be found in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT.

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

A New Method of Chemical Analysis

IN a lecture delivered before the Royal Institution in the spring of this year, and reported on in *Nature*, Prof. J. J. Thomson made a communication which will mark one of the chief scientific achievements of the year. Sir Joseph's connection with the corpuscular theory of matter and his heroic attacks upon the most fundamental problems of chemistry, such as are presented to us in the periodic table of the elements, is known to our readers. Until recently J. J. Thomson's theory of the atom, while representing with remarkable truthfulness certain of the chemical properties of matter, was still largely theory. The work reported on in the lecture referred to above may be said to represent the first and most important step toward the realization by experiment of some of the conjectures which flow from the hypotheses advanced by the great physicist some years ago. The experimental arrangement followed is to project positive rays through a vacuum tube containing traces of the materials under examination, and to subject the rays to the influence of a magnetic and electrical field, disposed at right angles to one another. Under these circumstances, the ray is deflected and from the nature of the deflection it is possible to determine the mass of the molecules or atoms within the tube. The course of the ray is recorded photographically, and if several substances are present, a number of separate curves are obtained, forming a "positive ray spectrum." Our first illustration shows the spectrum of nitrogen prepared from air. Measurements on this photograph show that the atomic weights of the carriers producing the spectrum curves were as follows:

Positive.		Negative.	
1.00	H+	1.00	H—
1.99	H_2+	11.20	C—
6.80	N++	15.20	O—
11.40	C+	....	..
13.95	N+	....	..
28.10	N_2+	....	..
39.00	Arg+	....	..
100.00	Hg++	....	..
198.00	Hg+	....	..

The symbol H+ denotes that the carrier is an atom of hydrogen with one charge; H_2+ that it is a molecule of hydrogen with one charge; N++ that it is an atom of nitrogen with two charges, and so on. A case of the highest interest is the positive ray spectrum of marsh gas. (Fig. 2.) The remarkable feature in this is that it discloses the presence, not only of marsh gas, CH_4, but also of substances having molecular weights, 12, 13, 14, 15, thus corresponding to bodies C, CH, CH_2, CH_3. With regard to these, Sir Joseph remarks: "If I am not mistaken, this is the first occasion when the atoms CH, CH_2, CH_3 have been observed in the free state." The significance of this discovery to chemistry can hardly be over-estimated.

Schonbein remarked years ago—though the same words have held true until practically the present day: "Shakespeare says that 'there are more things in heaven and earth than are dreamed of in philosophy.' Thus, presumably, intermediate between the state in which two portions of matter exist after completion of chemical combination and the state in which they previously existed separately, there is a series of transition states of which the chemistry of to-day knows nothing." It appears that now Sir J. J. Thomson has given us the key that opens the entrance to this realm of natural phenomena, which, until now, has been practically a sealed book to us.

An Important Step in the Problem of Television

THE electro-telescope, or "electric eye," invented by Prof. Rosing of the St. Petersburg Technological Institute, is said by Prof. Ernest Ruhmer, himself a diligent and successful worker in this field, to mark an important step toward the practical solution of the problem of television. Prof. Rosing's ingenious apparatus, which has already been mentioned in the SCIENTIFIC AMERICAN SUPPLEMENT of June 17th, 1911, is described as follows by Prof. Ruhmer in a recent issue of *Die Umschau:*

The transmitting apparatus (Fig. 1.) is connected with the receiving apparatus at the distant station (Fig. 2) by six wires. Instead of the selenium cell used in most systems for transmitting gradations of

Fig. 1.—Positive ray spectrum of nitrogen.

Fig. 2.—Positive ray spectrum of marsh gas.

light and shade, Prof. Rosing employs a photo-electric cell, which reacts much more quickly. This photo-electric cell *F* (Fig. 1) consists essentially of a glass globe, filled with rarefied hydrogen or helium and with its lower hemisphere coated internally with an amalgam of sodium or potassium, which is connected with the negative pole of a galvanic battery, the positive pole of which is connected with a platinum electrode which is fused through the glass at the top of the globe. In these conditions no current passes so long as the globe remains in darkness. If, however, the amalgam which forms the cathode is illuminated, the rarefied gas is traversed by a current, the strength of which has been found by Righi and Stoletow to be directly proportional to the intensity of illumination and to follow exactly every variation of the latter.

In Prof. Rosing's transmitting apparatus (Fig. 1), an image of the object or picture *MN* is thrown, by the lens *L* and the two polyhedral mirrors *A* and *B*, upon an opaque screen having a small aperture *a*, which is placed in front of the photo-electric cell *F*. The mirrors *A* and *B* rotate on mutually perpendicular axes with different velocities. The image is displaced in the plane of the drawing by the mirror *B* and in a direction perpendicular to that plane by the mirror *A*. By the combined action of the two mirrors the image is moved across the opaque screen in a series of parallel paths, so that every part of the image falls successively on the aperture *a* and illuminates the photo-electric cell *F* within a small fraction of a second.

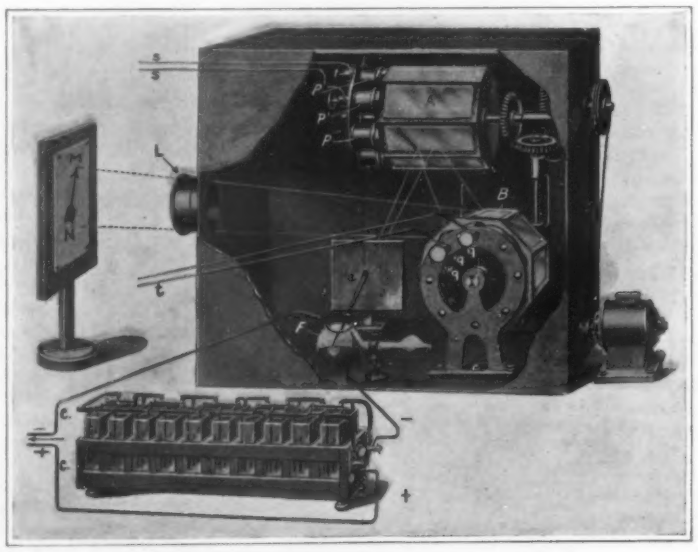


Fig. 1.—Rosing's transmitting apparatus for television.

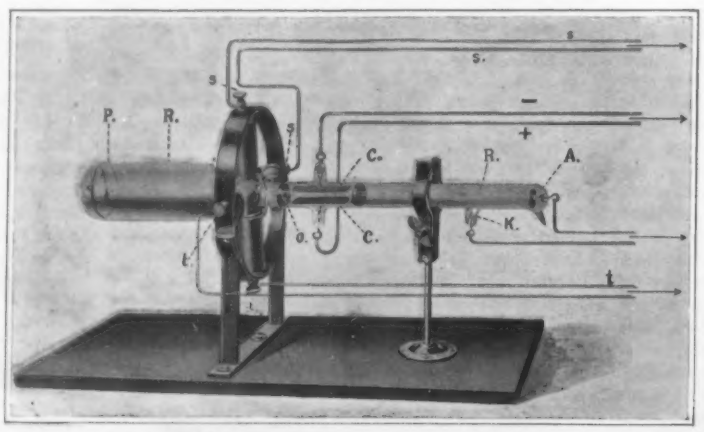


Fig. 2.—Rosing's cathode ray receiver.

The picture is reproduced at the receiving station by means of a Braun's tube. This device is an evacuated glass tube (*R*, Fig. 2) containing two electrodes, *A R*, which are connected with the poles of an influence machine or other source of electricity of high potential. The cathode *K* emits cathode rays which fall upon a diaphragm through which a small pencil of the rays passes to a screen *P*. This screen is coated with potassium tungstate which is excited to fluorescence by the impact of cathode rays, so that a small luminous spot is formed at the point where the pencil of rays strikes the screen. Cathode rays can be deviated by electrostatic and by magnetic force, and Rosing makes use of both agencies. The Braun's tube is surrounded by two pairs of electromagnets, *s t*. One pair of electromagnets deviates the pencil of cathode rays in the plane of the drawing, the other in the perpendicular direction. Each of the mirror-drums *A* and *B* at the transmitting station (Fig. 1) carries a number of magnets which, as the drums revolve, generate electric currents in fixed cells, *p p′ p″* and *q q′ q″*, near which they pass. Each of these two groups of generating coils is connected by two line wires with one pair of the electromagnets which deflect the pencil of cathode rays at the receiving station. In each case the current, the magnetic field which it produces, and the deflection of the rays are proportional to the angular displacement of the mirror-drum, which also determines the position of the reflected image at the transmitting station. The pencil of cathode rays, therefore, moves over the fluorescent screen in exact accordance with the movement of the image. The brightness of the fluorescent spot which thus reproduces the image at the receiving station is regulated by the condenser plates *C C* (Fig. 2) which are placed inside the Braun's tube and connected, respectively, through two line wires, with the positive pole of the battery at the transmitting station and with the platinum electrode of the photo-electric cell *F* (Fig. 1), while the negative pole of the battery is connected directly with the amalgam coating of the cell.

In these conditions the strength of the electrostatic field between the condenser plates is proportional to the intensity with which the photo-electric cell is illuminated. The pencil of cathode rays which passes between the plates is correspondingly deflected so that a larger or smaller part of it is enabled to pass through a second diaphragm (*o*, Fig. 2) which is interposed between the condenser and the fluorescent screen, the diaphragms being so placed that no rays fall on the second one when the condenser carries no charge. Hence the brightness of the fluorescent spot which moves over the screen at the receiving station is always proportional to that of the corresponding point of the original image, and as the entire operation is repeated many times in a second, the fluorescent screen presents to the eye, in consequence of the persistence of retinal impressions, a motionless and exact monochromatic reproduction of the original picture.

Science

Scientific Researches in Spitzbergen.—A German research institution has been established in Spitzbergen, and Drs. Rampp and Wagner have begun a year's work there, in ærology and geophysics. A unique interest attaches to the observations of the upper air that will be made throughout the polar night.

Aerial Post in Italy.—The latest country to try an aerial postal service is Italy. The Italian aeronaut Dal Mistro recently carried a sack of mail between the Bologna and Venice postoffices in a Deperdussin monoplane, covering the distance of 101 miles in 1 hour and 28 minutes.

The Utilization of Grape Pips.—The utilization of by-products is one of the most striking characteristics of modern industry. A recent example is found in Italy, where a means has been discovered to turn to account the hitherto worthless pips of the grapes used in wine-making. Oil is now extracted from them on a commercial scale by a process of direct heating with tetrachloride of carbon. The latter is obtained in abundance in Italy in the preparation of electrolytic soda.

Nobel Prize Winners.—On December 10th, King Gustav of Sweden presented the Nobel Prizes, with the exception of the peace prize, to the winners. Mme. Marie Sklodowska Curie personally received the prize for chemistry, Prof. Wilhelm Wien of Wuerzburg University the prize for physics, and Prof. Alivar Gullstrand of Upsala University the prize for medicine. The Belgian Minister received the prize for literature in behalf of Maurice Materlinck, who was ill. The Nobel Prizes each amount to nearly $40,000.

Upper-air Research in Canada.—The Meteorological Service of Canada has been making observations of the upper air with sounding balloons since February last, and has achieved some excellent results. Of sixteen balloons sent up, eight have been recovered to the present writing. The altitudes attained have varied from 11.2 to 23.2 kilometers (about 7 to 14 miles). The isothermal layer was found at an average height of 13 kilometers (8.1 miles). The lowest temperature recorded was 70 deg. below zero Cent. (94 deg. below zero Fahr.) at an altitude of about 8.7 miles.

A Meteorological Tea.—In connection with the Washington meeting of the American Association for the Advancement of Science an informal gathering is to be held at the Weather Bureau, Thursday afternoon, December 28th, from 5 to 7, when "The Relation of Meteorology to Other Sciences" will be discussed, and the visitors will be given an opportunity of inspecting the installations and work of the bureau. Eminent representatives of several sciences have been invited to make brief addresses on the meteorological bearings of their several fields of work. The promoters of this undertaking hope that a similar *conversazione* or tea may become a permanent feature of the association's annual meetings, at which meteorology has not heretofore been represented in any definite way.

The Bend of the Brahmaputra.—We recently referred in these columns to the remarkable fact that the great bend of the Brahamputra—where the river turns southward, in Tibet, and begins its course toward the Bay of Bengal—remains to this day a geographical question-mark for a distance of nearly a hundred miles. Probably no one bit of the earth's surface, with the exception of the poles has been the object of such keen curiosity on the part of geographers. It is now reported that the British authorities in India are preparing a punitive expedition against the savage Abors—whose hostility has been the chief obstacle to the exploration of the region in question, and whose latest misdeed was the murder of Mr. Noel Williamson and Dr. Gregorson. In the course of this expedition it is almost certain that the unknown stretch of the river will be explored, and the identity of the Tibetan Tsangpo with the Brahmaputra will be fully established.

The Canton-Hong-kong Railway.—The American consul general at Hong Kong reports the formal opening on October 4th of the Canton-Hong-kong Railway. The British section, which was built by the colony of Hongkong and opened about a year ago, extends from Hongkong or Kowloon to Sam Chun, about 22 miles; it is tunneled through many mountains and cost $5,164,710. The Chinese section, built by the Chinese government with money lent by the colonial government of Hongkong, extends 89 miles from Sam Chun to Canton, and cost $6,510,000. The freight cars were mostly imported from England, but the passenger cars were made in the shops of the Railway Administration of North China, except those of the British section, which were made in Hong-kong. Some of the rails are from Chinese works at Hankow. In fact, a noteworthy feature of this and other recently built railways in China is the large amount of the equipment that is Chinese-made

Electricity

Meat Shrinkage in Electrical Cooking.—A recent consular report calls attention to the tests at the London Electrical Exposition which demonstrated that the shrinkage of meat when cooked in a coal range is somewhat greater than that of the same meat cooked in a gas range, and considerably more than when cooked in an electric range. A leg of mutton weighting 8 pounds and 8 ounces showed a shrinkage of 2 pounds and 11 ounces when cooked in the coal range, whereas a leg of mutton weighing 9 pounds showed a loss of 1 pound and 4 ounces when cooked in an electric oven. The shrinkage for the gas oven was 2 pounds and 4 ounces on an 8-pound leg of mutton.

Helium Tubes as Light Standards.—It was brought out at the meeting of the Philosophical Society of Washington last November that the Bureau of Standards has been experimenting with various gases, with a view to obtaining a vapor lamp which may be used as a light standard. The best gas was found to be helium. The light produced in the helium tube is a yellowish white, similar to that of the Hefner flame, and of carbon filament lamps. Other gases which seemed promising were dioxide and sulphur dioxide, but these were rejected, owing to the fact that the light they emitted was too white. The helium tube shown by experiment to be best adapted for the purpose was 7 centimeters long, with a bore of 2 millimeters and a wall 2 millimeters thick. The tube was provided with terminal bulbs 35 millimeters in diameter, containing aluminium electrodes 25 millimeters in diameter. With this form of tube the density of the gas did not affect the light over a range of 3 to 8 millimeters pressure, and a practically constant light was emitted, even though the voltage and the frequency of the current varied considerably.

Paris Suburban Railroad Electrification.—It will be remembered that a project is on foot for electrifying the whole of the Paris suburban railroad lines belonging to the West State system, and the expense of carrying this out is estimated at nearly $30,000,000. No definite decision has been made as to what electric method will be employed for running the trains. The plans left over from a former commission called for the use of a line somewhat resembling the Metropolitan subway, and the new commission is engaged in bringing these up to date. This method of looking at the subject is criticised, however, by outside engineers, as they claim that the suburban lines should not be operated on the same plan as the subway by direct current motors, but that such roads should be considered as part of the trunk lines and would be better run on the single-phase system, such as is adopted by the Prussian, Swiss and Swedish governments and elsewhere. The advantage would be felt when it comes to extending the suburban lines, as this can be done indefinitely, while it would be difficult on the present plan. Besides, there would be no need for substations placed along the road. As there are 130 miles of suburban track, this would require quite a number of such stations.

Around the Globe by Wireless.—A project is being developed in France by which it is expected to send wireless messages around the globe, and this will be done by erecting stations in the French colonies. A commission has already been formed by the colonial department to carry out the enterprise, and Comm. Ferrié, the well-known wireless engineer who is at the head of the Eiffel Tower plant, is in charge of the technical matters. Not more than $2,500,000 will be required for the twelve wireless stations called for by the programme, and it should be completed in about two or three years. Messages sent out from the Eiffel Tower at Paris will first reach the posts erected at Dahomey and Timbuctoo in west Africa. Thence they will cross the continent to the coast of the Red Sea at Djibouti or else proceed southeast to Madagascar. Either of these two posts can then send messages across the Indian Ocean to the post in India at Pondichery, whence they will be transmitted to the eastern coast of Asia at Saigon. About 5,000 miles separate this point from the island of New Caledonia, to the north of Australia, and this can be covered by a high-power station. The Pacific will then be crossed by stations at Tahiti and the Marquise islands. It then remains to cross over Central America so as to reach Martinique in the Atlantic, then crossing the ocean to the west African coast at Rufisque. From here the circuit around the globe will be completed to Paris. The main object of the French enterprise is to connect the capital with all the colonies spread over the earth's surface and also to connect all the colonies among themselves. This will give a great advantage over the present telegraphic cables, which frequently break and need repairs and are often owned by foreign companies. It is interesting to note that the waves sent from the Pacific to the Atlantic posts will cross over the region of the Panama Canal.

Aeronautics

Moving Pictures from an Aeroplane.—The photographer who accompanied Robert G. Fowler on his coast to coast trip for part of the way, has been taking motion pictures from Fowler's aeroplane. It is stated that a special apparatus was employed to overcome the vibration caused by the aeroplane engines. We are not informed whether the films are a success

Vedrines' Falls.—On December 8th, Pierre Vedrines fell with his monoplane at Morannes from a height of 75 feet. His collar bone and right arm were broken. This would not be so serious were it not for the fact that grave internal injuries were also sustained, with the result that some concern is expressed whether or not Vedrines will survive the accident. He had only just recovered from a very bad fall at Hericourt on September 13th, in which two of his ribs were broken. Vedrines is one of the crack flyers of France.

An Adverse Wright Decision.—The suit brought by the Wright Company against Claude Grahame-White for damages resulting from an alleged infringement of their patent has been decided in Mr. Grahame-White's favor by the United States Court, Judge Hand presiding. The judge said: "It is well settled by numerous authorities that the word 'damages' in the section includes profits. Therefore, under the complaint as it now stands the complainant cannot recover upon the accounting any damages or profits prior to the bringing of the suit. The question of costs is reserved for final action."

Final Award of the Statue of Liberty $10,000 Prize.—At a meeting of the International Aeronautic Federation in Rome last month Grahame-White was finally awarded the $10,000 prize for the race from Belmont Park to the Statue of Liberty and back, which was flown during the meet at Belmont Park a year ago. The two other competitors, the late John B. Moisant and Count de Lesseps, were each declared to be the winner of this prize at one time or another, but Grahame-White's protests that Moisant had not flown one hour continuously at the meet in accordance with the rules and that Count de Lesseps fouled a pylon were sustained.

The Aeronautic Shows in Paris and New York.—The Third International Exhibition of Aerial Locomotion opened in the Grand Palais in Paris on December 16th. The great advance made in aviation during the past year was apparent from the great number—about two score—of excellent aeroplanes on view in the main hall, as well as from the large number of makers of accessories who exhibited in the galleries. All told, about 350 makers of aeroplanes and accessories had their product on exhibition. With the exception of one Englishman and two Germans, all the exhibitors were French. Fifteen different makes of aviation motors were on view. Many lectures by men prominent in aeronautics will be given during the fortnight the exhibition is open. New York's first big aeronautic show is to be held next May under the auspices of the Aero Club of America.

An Aerial Taxicab.—Blériot has built for Henri Deutsch de la Meurthe a veritable aerial taxicab. The machine has a body which looks for all the world like that of a taxicab body. The passengers enter by a side door and view the landscape below through mica windows. Pneumatic cushions protect the passengers in rough landings. The pilot sits in front of the machine like a true chauffeur, and controls the machine with regular Blériot *cloche* and foot tiller. There is even a speaking tube to facilitate communication between the passengers within the taxi and the chauffeur. The elevator has been placed in front instead of in the rear. A 100-horse-power Gnome engine is mounted on top of the cab, and with it the fuel tanks. The spread of wing is 43 feet from tip to tip, and the over-all length is 46 feet. Ready for flight, without passengers, the aeroplane weighs 1,540 pounds.

Recent Aeroplane Fatalities.—On December 2nd, Tod Schriver, one of the first fliers to be taught by Curtiss, was killed by a fall at Ponce, Puerto Rico. He had been flying in a strong wind about 10 minutes, and was descending in order to alight when he made a sharp turn and at the same time accidentally accelerated his motor. The result was that the biplane tipped still more and then slid sideways to the ground. It struck on one end in a cane field, and Schriver was so badly hurt that he expired soon after. The same day Lieut. Baron von Freytag-Loringhoven fell and was killed at the Doeberitz military aviation field in Germany, while on the 3rd inst. another German aviator, Herr Reeb, met with the same fate while flying across country from Munich to Nuremberg. Three days later Hubert Oxley and his passenger Weiss fell to their deaths at Filey, England, while flying a powerful Blackburn monoplane. On December 13th Lieut. Charles Lantheaume, a French military aviator, was killed by a fall at Melun just as he arrived after a successful flight from Etampes.

View in the sorting room of an artificial silk factory.

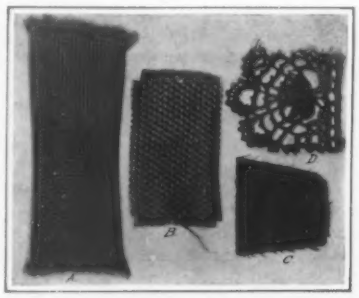
Artificial Silk—A Textile Marvel

Making Lustrous Yarn from Wood Pulp

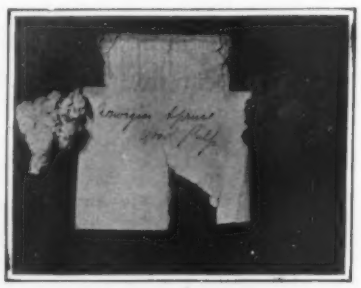
By H. W. Ambruster

"YOU can not make a silk purse out of a sow's ear" is a familiar quotation. Its use, however, will probably be discontinued by the next generation, as silk is now made artificially by mechanical means out of material which, if not a product of the pork packer's slaughter house, is about as low down in the aesthetic scale. Wood pulp—made from spruce trees, or in fact from any variety of wood—is dissolved in various chemicals and the solution is spun into a beautiful lustrous yarn, the sheen and gloss of which outrivals the most costly cocoon silk. An industry of enormous proportions has been built up with the development of this new product, factories in Austria, France, Germany, and more recently in England turning out many thousands of pounds of the yarn every day.

And at the present time an enormous plant is just starting to manufacture in this country (near Chester, Pa.), making the same product. In certain textile lines, notably the braids and trimmings for women's dresses and hats and in knitted neckties, the artificial silk or wood silk as it is sometimes called has practically replaced the real article. Probably ninety per cent of the braids and passementerie now manufactured are wood silk, though the retail consumer seldom realizes this fact. The yarn is also used largely in tapestries and curtains and dress goods, while ribbons and various other fabrics supply an almost limitless field which is being invaded by this latest triumph of man's ingenuity. True synthetic silk has been made by chemists, it is claimed, the product of the cocoon being absolutely duplicated in every respect, chemical and physical, but this achievement, successful as it was as a scientific laboratory experiment, had no commercial value on account of the enormous cost of production.



A, B, D, are made entirely of artificial silk. C is a dress fabric made of worsted and artificial silk.



On the right is shown some raw cotton seed fiber; on the left, pure cellulose made therefrom; in the center, some spruce pulp.

A Frenchman, Hilaire de Chardonnet by name, was the first to make wood silk on a commercial basis; and although he is now very wealthy, it is said that he went into bankruptcy several times before he was finally successful. Chardonnet used a solution of nitro-cellulose in which sulphuric ether is the solvent, and several of the largest of the European mills are still using his process or modifications of it. The second process to be developed commercially was based on the use of what is known as the cuprammonium solution of cellulose in which copper salts and ammonia are the solvents. A third cellulose solution was discovered about twenty years ago by the English chemists, Cross and Bevan, and "viscose," as it is called, is now rated as the best of them all for making the artificial filaments.

The nitro-cellulose process depends on the use of the same solution that is used for making celluloid and guncotton and the first yarn made from it was highly explosive and dangerous to handle being therefore impracticable as a commercial article. After numerous failures, however, the French inventor discovered a way of denitrating the finished yarn and thus made it no more explosive or inflammable than so much cotton or paper. A German chemist by the name of Lehner made further improvements in the Chardonnet process and now there are great factories at Besançon in France; at Frankfort, Germany, and Zurich, Switzerland, where thousands of pounds of Chardonnet silk are manufactured daily. The nitro

Winding and skeining artificial silk in a large European factory.

MAKING SILK FROM WOOD PULP

cellulose solution, made by dissolving the wood pulp in ether, is squirted through exceedingly fine jets or capillary tubes of glass. As it emerges either into a water bath or into the air the cellulose originally held in solution partially solidifies and a gummy filament is the result. A number of these filaments, 12 to 20, are gathered together and twisted into a yarn in the same way that cocoon silk threads are spun or thrown together. The artificial silk threads, while still soft and gummy are then stretched on drums or reels and dried, during which process they take on the beautiful luster so eagerly sought for by silk manufacturers.

The process of making viscose silk starts from an alkaline solution of cellulose. The wood or cotton pulp is treated with caustic soda until a mercerization somewhat similar to the chemical reaction in mercerizing cotton yarn has taken place. But the decomposition is carried much farther in making viscose. Bisulphide of carbon is then added to the partially decomposed pulp and the fibrous nature of the material disappears, altogether leaving a gummy mass which passes into a perfect solution when weak caustic liquor is added. For spinning the viscose solution somewhat different apparatus has been developed from that used for the earlier processes.

All mechanical impurities, etc., are removed from the viscose solution by filtering the same through cotton wadding and cheese cloth. The clear solution then passes to a small platinum cap in which are drilled 15 or 18 holes approximately 4/1000 inch in diameter. The cap is immersed in an acid bath and the alkali in the viscose as it emerges from the spinneret is neutralized by the acid, the particles of cellulose coming together into 15 or 18 filaments according to the number of holes in the cap. Instead of being wound upon a reel at this point these delicate threads are dropped over a bobbin or pulley wheel into a small hole in the top of a rapidly revolving spinning box. This box turns at some 1,500 revolutions per minute, and the centrifugal force throws the filaments away from the center and winds them up in a cake, also putting a slight twist into the resultant yarn. The yarn is then reeled into bundles or skeins on a regular silk winder, being drawn from the inside of the cake.

The advantage of this method of spinning the soluble cellulose, as compared with former methods in which the filaments were reeled into skeins as soon as spun, is the delicacy of the apparatus. The filaments, until they have been stretched and dried, are exceedingly frail and the less they are handled, the more perfect the yarn produced.

All of the artificial silks take the same dyestuffs as cotton and are readily dyed, the luster being brilliantly accentrated especially by certain shades. Care has to be taken, however, while the skeins are wet as the filaments loose much of their strength while in this condition. The cellulose is very hygroscopic and after absorbing a large percentage of water, swells up and its physical structure is much weakened. But as soon as the yarn dries again it is as strong as ever, and the luster returns with all of its original brilliancy. The appended table, prepared by Haller, a French expert, shows some interesting figures obtained as the result of strength tests with various samples.

All the forms of soluble cellulose are progressive solutions, the chemical reaction being continuous, and great care has to be taken to spin the mixtures at exactly the right moment to get the best results. In consequence, a fixed temperature is necessary for all rooms in which the solutions are mixed and aged.

The artificial silk filaments when dry are of almost incredible fineness, one pound of yarn of some sizes containing as many as six hundred miles of individual filaments. The bulk of the yarn spun contains about 33,000 yards to the pound, 18 filaments being twisted together to form the yarn. A conservative estimate of the total length of the filaments produced daily at the present time by the world's factories is considerably over 3,000,000 miles every 24 hours.

Cotton pulp is used instead of wood pulp in some of the foreign artificial silk factories and has been experimented with extensively in the United States, but wood pulp seems to be considered more suitable. At the present time about 20 per cent of the world's consumption of silk yarn is the artificial product.

Many millions in money have been expended in Europe and America in the perfection of the various processes for spinning artificial silk, and as is usual in the development of a new industry, the inventors and original pioneers as a rule have reaped but a small share of the profits. The first American group to exploit viscose expended over $1,000,000 in experimenting, without obtaining any return whatever.

	Absolute Strength in Kilogrammes per Millimeter of Diameter	
	Dry Thread.	Wet Thread
Cotton, ordinary thread.....	11.5	18.6
Cocoon or Real Silk raw (in the gum)..	50.4	40.9
" " " boiled off (gum removed)	25.5	13.6
" " " dyed black and weighted to 111 per cent	12.0	8.0
Artificial Silk, French-Nitrocellulose-Chardonnet	14.7	1.7
" " German - Nitrocellulose-Lehner	17.1	4.3
" " French - Cupra - ammonium-Pauly ..	19.1	3.2
" " English-Viscose-Stearn	21.5	3.5

In another generation, however, the manufacture of artificial silk will probably be standardized, and as well understood as the wool and cotton industry of to-day.

The World's Oldest Liqueur Distillery

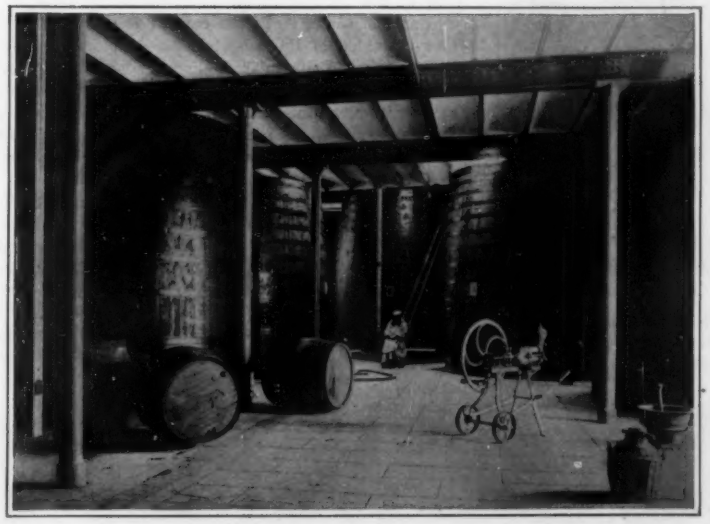
A Monastic Plant Dating Back to 1084 A.D.

THE world's oldest distillery well deserves its title, for it has been making the liqueur known as Chartreuse since the jolly Saint Bruno dedicated La Grande Chartreuse to the manufacture of this historic cordial in 1084. For hundreds of years, Chartreuse has issued from this monastic plant, designed as a monastery, and built like one, with its iron-barred windows.

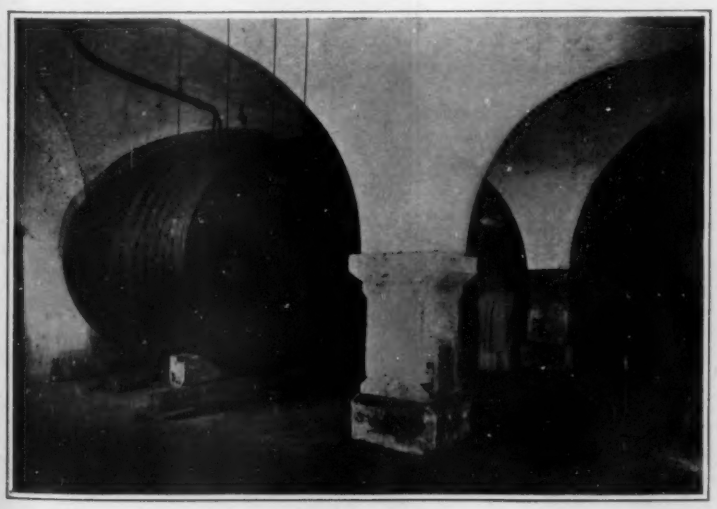
In the great building constructed for the monks not employed in the distillery, the cells were lighted only by iron-grated doors and the inmates here lived year after year without seeing the sun, receiving their food through the opening in the grated door and spending the hours in prayer, reading and work. No one, outside of the monks working in the distillery, was allowed within its doors and the priestly workmen themselves did not know how the liqueur was made.

The first to discover the secret of making chartreuse from the rare herbs that are found in the Dauphine Alps which separate France from Switzerland was Bruno. How he learned it is not known. Some of the French mountaineers may have had crude liqueur stills; but history has no record of the fact. Bruno kept the recipe to himself and mixed the aromatic herbs in the right proportions, in a vault where not even the monks could see him. He alone knew the exact temperature to maintain in the steeping vats, and the different lengths of time needed to extract the essences from the various herbs. The mixing of the liquids was also done exclusively by the saint. None but he could gage the exact proportions to make the perfect blend. When age caused Bruno to give up his duties, his successor was obliged to take an oath that he would tell no one of the secret processes, and that he would perform Bruno's work until compelled to give it up; when he would hand down the re-

(*Continued on page 585.*)



Liqueur vats and portable pump for serving them.



The ageing vault.

Monks at work on herbs and fruits, used in making chartreuse.

THE WORLD'S OLDEST DISTILLERY

Copyright American Photo. Co.

Panoramic view of the "Maine" and the inclosing cofferdam. To the extreme left is the bow, broken off and thrown around to starboard.

The bow, torn entirely away from the hull, was thrown around to starboard. The stem lies at right angles to the keel and in a horizontal position.

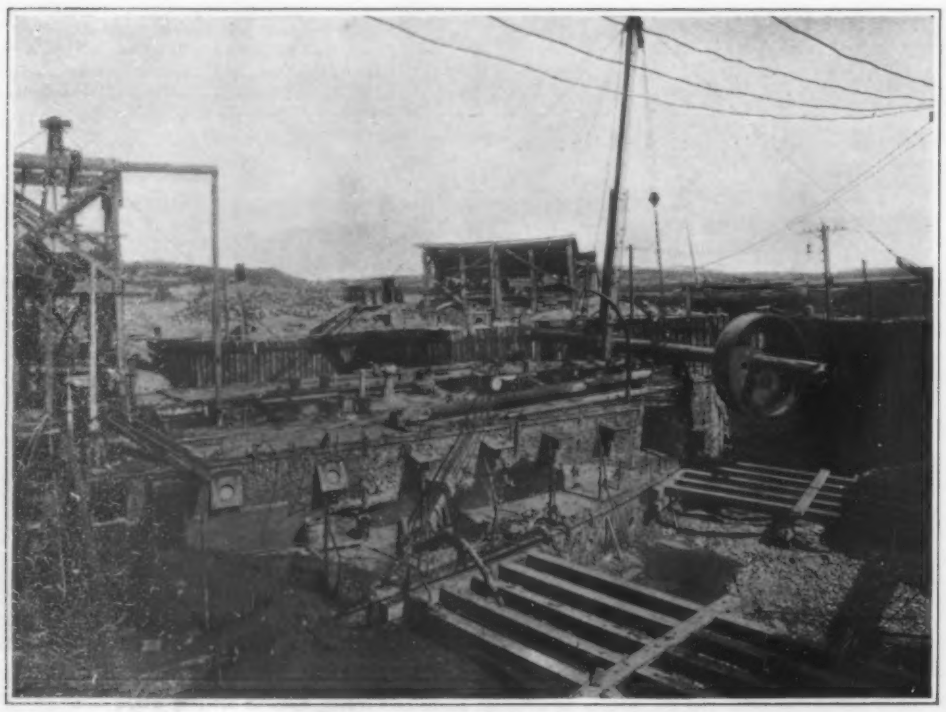
Destruction of the "Maine" by a Low-exp

THE Engineer Corps of the United States Army is to be congratulated upon having brought to a successful conclusion a difficult and unique work of marine cofferdam construction and excavation which, in this particular class of work, is without parallel in the history of engineering. We refer to the successful unwatering of the sunken battleship "Maine." Sunken vessels have been recovered in various ways, but never, so far as we know, has a ship lying on the bottom been salved from the water by the method adopted in the case in question. The recovery of a ship of six or seven thousand tons displacement, lying in 37 feet of water upon a bed of mud and soft clay of approximately equal depth, is a problem of considerable magnitude, even when the hull of the ship is in an approximately sound condition; but when, as in the case of the "Maine," the forward third of the vessel has been blown entirely to pieces, the difficulty is many times multiplied. When the army engineers received instructions to recover the "Maine" so that every part of the ship could be subjected to a thorough examination, they were confronted with a problem which they might well have pronounced impossible of solution.

The plan adopted of building entirely around the wreck a massive cofferdam wall extending from solid bottom to several feet above high water mark, was the subject of much criticism from the day the plans were first made public. Complete failure of the cofferdam was freely predicted by the engineering profession. Yet in spite of the difficulties due to the tendency of the mud-filled wall to leak and to yield by distortion, the fact remains that it has done its work, and that the army engineers have so far laid bare the wreck that not only will the after two-thirds of the ship be floated and towed away to be sunk at sea, but practically every part of the wrecked portion of the structure has been made to yield its quota of evidence in determining the first cause of the disaster.

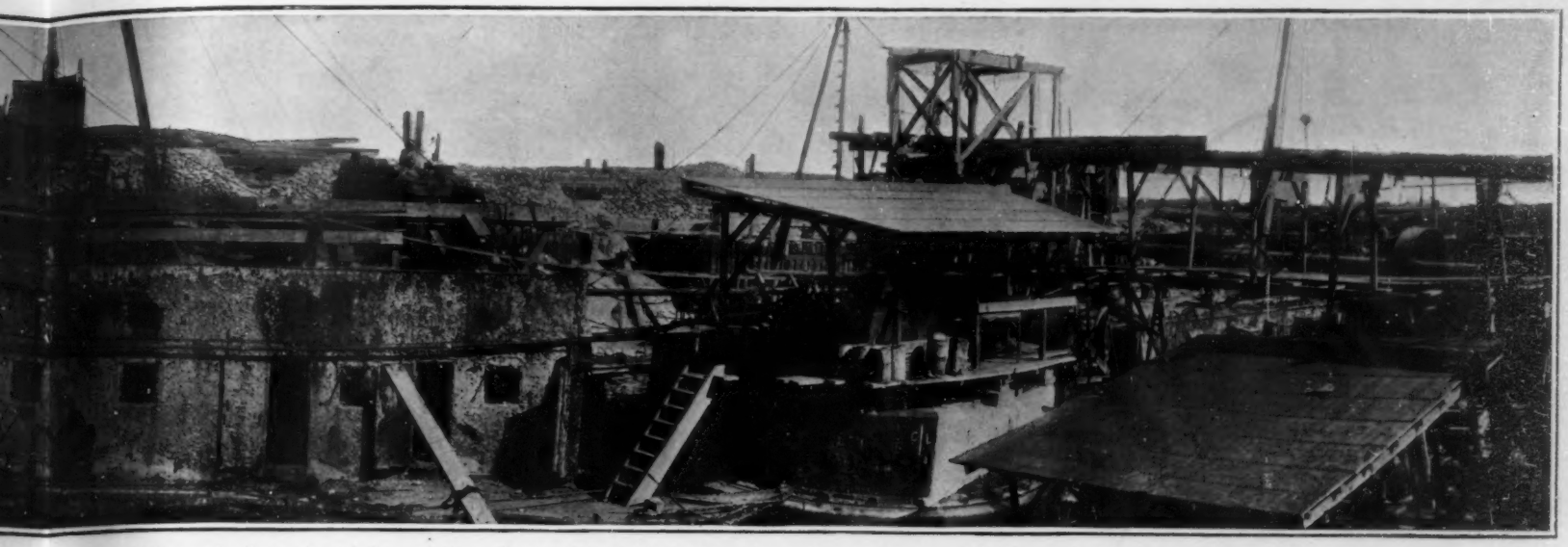
The joint army and navy board appointed by the Secretary of the Navy has presented its report, and an advance official statement has been given out at Washington which says, "The board finds that the injuries to the bottom of the "Maine" were caused by the explosion of a charge of a low form of explosive exterior to the ship between frames Nos. 28 and 31, strake B, port side. This resulted in igniting and exploding the contents of the 6-inch reserve magazine, A-14-M, said contents including a large quantity of black powder. The more or less complete explosion of the contents of the remaining forward magazine followed. The magazine explosions resulted in the destruction of the vessel."

The investigation disclosed the fact that there is a fracture some 20 feet wide extending across the bottom of the vessel at a point about 100 feet from the bow. From the fact that the frames were still in position, though, of course, much distorted, the board concluded that a low form of explosive was used in destroying the vessel. A high explosive would have caused a much more complete destruction of the material in its immediate vicinity. Incidentally, the report sustains the findings of the Sampson board, which investigated



Quarter deck and officers' quarters. Note the heavy timbers bracing the walls of cofferdam from the hull of the ship.

One of the torpedo tubes as revealed when cleared away. At this spot outboard the



to starboard. The boiler marks the region of the explosion. To the right of this is the after portion of the ship, which is practically intact.

w-explosive Mine and Her Own Magazines

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the disaster in 1898, immediately after the "Maine" was blown up. That board located the point of the exterior explosion at about frame 18 on the port side, but its report was based upon an examination by divers working in 37 feet of water. The unwatering of the "Maine" has made possible a closer approximation to the truth and it is now disclosed that the point at which the vessel was ruptured lies between frames 28 and 31.

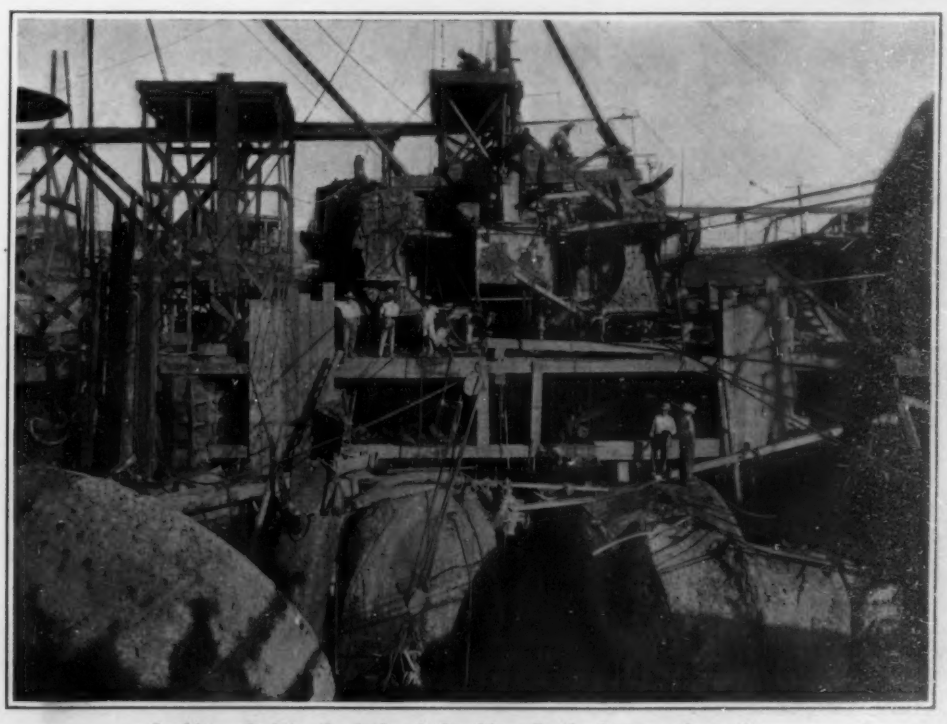
The after portion of the hull remains practically intact. Forward of frame 30 is a gap of about 20 feet, where the ship was cut in two, and forward of the confused wreckage lies the bow, which was blown entirely out of position, swung around to starboard, and broken off from the ship's structure at frame 14. The stem of the vessel, instead of being in the vertical position, now lies horizontally and at right angles to the keel of the vessel, a considerable section of the plating on the port side being still attached to the stem. A long strip of the double bottom lies on the top of the after edge of the severed bow, and beneath this severed portion rests a section of the keel some ten feet in length. One end of it lies in the mud, and the other end, twisted backward and upward, is now resting against the shell of the detached section of double bottom. In places the keel has been turned entirely upside down, so that some sections of the bottom plating are uppermost.

The sequence of events on the night of the disaster is now clear. A charge of low explosive, probably a large quantity, was set off below the bottom of the "Maine," forward of frame No. 30 on the port side, and a few feet from the keel. How this destructive agent was contained, at what depth it was located, and how it was set off, will probably never be known. Whether the mine was touching the ship or on the harbor bottom, the force of the explosion would seek the line of least resistance, which would lie vertically through the body of the ship. The rush of gases tore through the double bottom and the shock and heat of the explosion set off the black powder, of which there was a considerable amount in the magazine just above the point of explosion, and this, in turn, ignited the forward magazines. The enormous energy thus liberated, having the water below and on the sides of the hull as an abutment, expended its energy in tearing asunder and folding back the overlying protective and other decks of the ship.

The illustrations which were published showing the recent wreck of the French battleship "Liberté" were strongly suggestive of similar illustrations of the wreck of the "Maine," published shortly after the event. The whole structure of the "Liberté" in the region of the explosion was opened out and folded back by the explosion of the magazines, presenting an appearance remarkably like that of the disaster in Havana Harbor. In the case of the "Maine" the magazines were set off by an exterior explosion, whereas on the "Liberté" the explosion was due to the deterioration and spontaneous ignition of the smokeless powder. It should be noted that outside of a comparatively small amount of ammunition for small arms, there was no smokeless powder on board the "Maine" at the time of the disaster.

View from amidships, looking toward bow, the wreckage of which is seen beyond the staging. To the right, in foreground, is one of the boilers; in the center is a portion of the keel.

ubes as revealed when the mud had been
n spot where found the remains of Lieut. Merritt.



Looking aft into the body of the ship. In the foreground are the boilers. Aft is the timber bulkhead to be used in floating the hull.

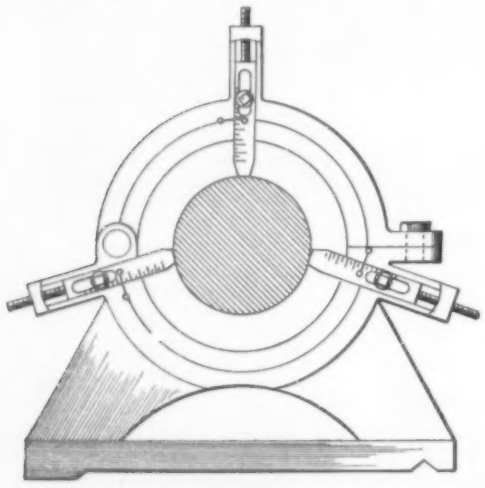
Suggestions for the Workshop

Ingenious Expedients of Resourceful Mechanics

A Steady Rest Kink

By H. D. Chapman

IT is a bothersome task to change the steady rest jaws to accommodate different sizes of work. The following method was used to advantage: The steady rest was placed in position on the lathe and a line was scribed around the face of the rest as shown at *A*. The jaws of the steady rest were then



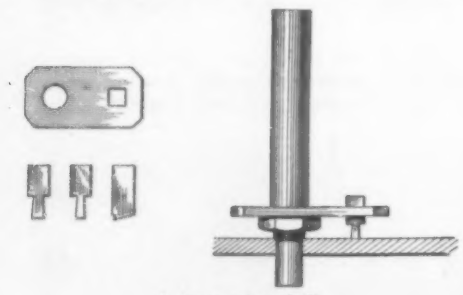
Steady rest with graduated jaws.

graduated in sixteenths of an inch on both sides of a zero line, as shown. The jaws were then placed in the steady rest and locked with the set screws after being set on the zero line. The jaws were then bored out while in position, thus making the graduation true.

Trepanning Drill

By Grover McKee

WHEN cutting out a hole in metal it is not necessary always to cut out all the metal in the form of chips and shavings. The most economical method is to cut out a piece of a desired diameter after the fashion of a surgeon when trepanning a skull. The accompanying illustration shows a method of doing this work. The drill consists of a shank provided with a reduced threaded portion and with a still further reduced projection, serving as a pivot. The plate



A trepanning drill.

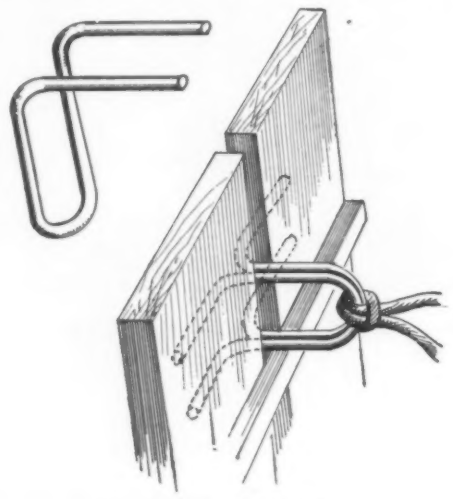
mounted on the shank is clamped in place by means of a nut which holds it securely against the shoulder of the shank. The plate is provided with a square aperture in which the tool is secured. The pivot of the drill is fitted into a small hole drilled in the center of the circle which is to be cut out. Then by driving the cutting tool into its socket and turning the shank, a circular slot will be made removing the metal in the form of a disk and leaving a hole of the desired diameter.

A Pocket Hitch

By Homer Cloukey

ILLUSTRATED in the accompanying drawing is a piece of stout wire about 8 inches long, shaped into a loop about an inch across with the free ends bent up at right angles to the plane of the loop. The drawing also shows the application of a pair of these bent wires to provide a hitch. They are slipped separately into a crack in a board fence and the tie rope or strap of a horse is attached. The girder of the fence will keep the strap from slipping to the ground and getting under the horse's feet.

This hitch may be applied to the side of a barn or any wooden wall if the owner carries a ¼-inch gimlet bit in his pocket with which to bore a couple of holes in the board. The chief advantage of this little appliance is that it can be carried in the coat pocket with convenience. It is also a feature that it can



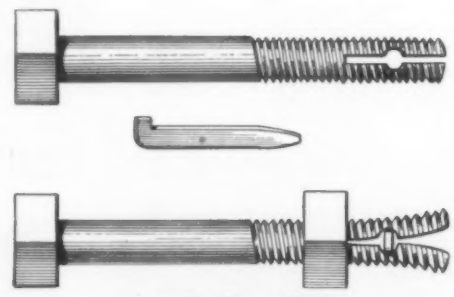
Wire hitch applied to a fence.

be made with the bare hands. The one drawback is that it will not hold a genuine "puller" which would pull the wires through the crack, but for ninety-nine per cent of driving and riding horses it is a reliable hitch.

Novel Lock Nut

By G. H. Ander

AMONG many devices for preventing nuts from working loose there is one in common use consisting of a cotter pin which passes through a hole drilled in the bolt. However, this is not perfectly secure. The writer has found the following method better: It consists in slotting the end of the bolt, lengthwise, with a hack saw, and after the nut is screwed into place, driving a small wedge into the hole to spring the ends of the bolt enough to prevent the nut from turning. The wedge itself may be held in place



A serviceable nut lock.

by bending the pointed end slightly. When it is desired to remove the nut, the wedge may be driven out, whereupon the nut may be unscrewed very readily. Sometimes bolts are riveted or center-punched in order to keep the nuts in their place. This, however, makes it difficult to remove the nuts and it requires that they be re-tapped. Furthermore, the bolts themselves must be run through a die before they may be used again.

Two Novel Reamers

By H. D. Chapman

IN the accompanying illustrations two types of reamers are shown which should prove very useful in the workshop. The form shown in Fig. 1 is known as a floating reamer, the cutting portion being connected to the shank by means of a knuckle joint. The writer recently had a number of gear wheels to bore to a finished size of 1⅛ inches. The hole was roughed out with a 1 7/64-inch drill, after which the floating reamer was used to bring the hole to size. The reamer shank is tapered to fit the tail stock, while the shank and the reamer are coupled together by means of a tapered pin indicated at *A*. This reamer was in constant use for ten days and gave excellent service.

The expanding reamer shown in Fig. 2 is notable for its simplicity of construction. Unlike the majority of expanding reamers, this reamer permits one to ream down to the bottom of a blind hole, as there are no projections beyond the front face. It has been found that

Fig. 1.—A floating reamer.

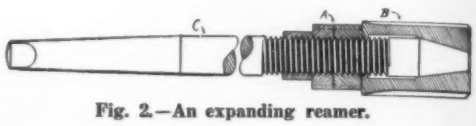


Fig. 2.—An expanding reamer.

with machine reamers there is an advantage in having a slight clearance behind the cutting edges, hence the reamer illustrated herewith is provided with such clearance. The shank of the reamer is indicated by the letter *C*. It is provided with a taper of 30 degrees at the end. Upon this shank is a lock nut *A* which may be turned by means of a spanner wrench. The cutter proper is indicated at *B*. This also is provided with flats for a spanner wrench, and there are six saw cuts in it, so that it can be expanded. In adjusting this reamer it will be found that the front cutting edge is expanded slightly more than that at the rear, so that it is possible to obtain a clean parallel hole.

Rotary Marking Gage

By William Grotzinger

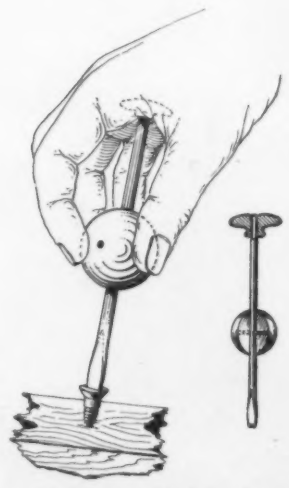
THE ordinary marking gage fitted with a pin to mark a piece of work is open to the objection that the pin is liable to follow the grain, especially in hard wood, giving an untrue line. The marking gage may be improved by substituting a steel disk roller for the pin. A small projection of wood may be secured to

A rotary marking gage.

the body of the gage and upon this a steel disk about three-quarters of an inch in diameter may be fastened with a small screw, permitting the disk to rotate easily upon the body of the screw. In use the disk will mark a true line regardless of the grain of the wood.

Improvement for Screwdrivers

PICTURED in the accompanying drawing is a very simple device which will be found useful on small screwdrivers. It consists of a swivel head secured to the upper end of the screwdriver and serving as a rest for the palm of the hand. The shank of the screw-



Screwdriver with swiveled palm rest.

driver is fitted with a handle in the shape of a ball, secured by means of a transverse pin. This may be turned readily by means of thumb and finger while the palm of the hand is resting upon the swivel head and holding the screwdriver firmly in place.

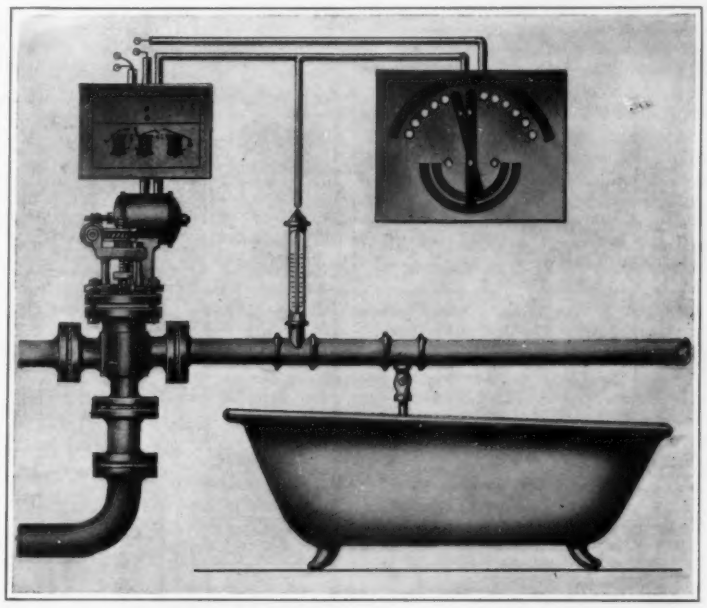
The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

Automatic Mixing Valve for Bathing Water

By Frank C. Perkins

THE accompanying illustration shows a unique German electrically-operated mixing valve by which any desired warm water temperature may be kept constant. It is adapted for use in large institutions, such as baths, sanitariums, and the like, as well as for various industrial purposes where constant temperatures are required. It will be observed that the temperature is controlled by a thermometer whose bulb reaches into the pipe containing the mixed hot and cold water. This thermometer is provided with platinum contact points connected to a double-switch lever, which may be set for the maximum and minimum temperature desired. This double switch may be seen directly over the bath tub in our illustration. Wires run from the switch to a set of relays, shown at the left-hand side, which control the circuit of a motor that operates the mixing valve. This valve connects either the hot water pipe or the cold water pipe or both with the mixed water supply pipes. The operation of the device is as follows: If it be desired to keep the temperature within the limits of 78 degrees and 82 degrees Fahrenheit, the two switch levers are adjusted accordingly. Thereafter, the apparatus operates automatically. If the temperature in the pipe with which the thermometer connects is below the minimum, the circuit of the motor will close automatically, opening the valve to the hot water supply until the temperature of the mixture has been raised to or above 78 degrees. If the mixture grows warmer than 82 degrees more cold water will automatically be supplied. A large number of bath tubs may be supplied through a single mixing valve and the temperature of the water supplied to each tub will automatically be maintained between the predetermined limits.



Automatic device for controlling the temperature of bathing water.

Removable Ambulance Linings

EVERY hospital for contagious diseases is now and then confronted with the serious problem of transporting persons without the loss of time necessary for proper disinfection of its ambulances. Many different patients, each suffering with a different disease, are received daily. Of course it is impossible to maintain a separate ambulance for each disease. A solution of the difficulty has been provided by the superintendent of a hospital in Buffalo. He has had five linings made which may be fitted into any of the hospital ambulances. One of these is used for scarlet fever cases only; another for diphtheria; another for measles; another for smallpox, and the fifth one for special suspected cases, or for other diseases not mentioned. These linings are stored in separate metal air-tight compartments built on a semi-circular platform at the edge of the garage turntable. The linings can either be disinfected in the ambulance, as all openings are made to shut tight, or they can be removed from the vehicle, placed on the ground and washed with soap and water. They may also be fumigated while in their storage compartments within the garage. Two men can exchange an infected lining for a clean one in five minutes. Thus a single ambulance is made the equivalent of five.

While this invention was originally designed for use by hospitals handling contagious diseases, it would no doubt be a benefit to the general hospital as well, because the latter is often called upon to transport patients supposed to be suffering with some simple malady, who, upon examination, prove victims of some dangerous and infectious disease. The advantage of using separate linings have been increased by the recent almost universal adoption of motor ambulances, which has rendered fumigation difficult, and washing almost impossible, because of wetting the electrical connections.

Particulars of the New Zealand Government's Offer of a Bonus of £12,000 (Nearly $60,000) in Connection With New Zealand Hemp

THE New Zealand Government has agreed to pay £12,000 (about $60,000) as a bonus or bonuses for improvements in connection with—

1. The extraction and dressing of fiber from the New Zealand hemp-plant (*Phormium tenax*), or
2. The utilization of the by-products obtained during the processes of extracting the fiber,

on condition that the machine or process in regard to which the whole or any part of the bonus is to be paid shall be recommended by the New Zealand Flaxmillers' Association, and approved by the Government.

The £12,000 will be paid, wholly or in part, for any of the following, viz.:

1. A process of extracting and dressing the fiber of New Zealand hemp (*Phormium tenax*), whether by machinery or otherwise, whereby there shall be obtainable (*a*) a greatly improved quality of fiber marketable at a higher price, or (*b*) a substantial reduction in the cost of producing the fiber.
2. Any such process that shall produce a fiber fit for use in manufactures other than rope and twine spinning.
3. Any such process that shall render unnecessary any of the present operations involved in extracting and dressing the fiber, such as stripping, paddocking, or scutching.
4. Any improved method of separating the green envelope or the flinty or colored matter from the green leaf of the phormium plant so as to produce a strong white fiber the whole of which can be saved with little or no tow or waste.
5. Any means whereby the by-products obtained during the processes of extracting and dressing New Zealand hemp-fiber—such as the gum, dye, stripper-slips, tow-dust, or

The lining partly withdrawn.

End view showing the interior.

MOTOR AMBULANCE PROVIDED WITH REMOVABLE LININGS FOR CONTAGIOUS DISEASES

waste vegetable matter—shall be converted into a marketable commodity.

Applications for the bonus must be addressed to the President of the New Zealand Flaxmillers' Association, Palmerston North, New Zealand, and must reach him not later than noon of November 30th, 1913. They must be inclosed in an envelope clearly marked "Application for bonus."

Each applicant shall state what lump sum (including the bonus of £12,000 or any part thereof) would be required to purchase the New Zealand rights of his machine or process in the event of such rights being acquired by the New Zealand Government for free use by the hemp-millers of the Dominion; or, if any applicant is unwilling to sell his rights, he shall state what amount of bonus (not exceeding £12,000) and what royalty he would require for the use of his machine or process.

As soon as possible after the expiration of the time for receiving applications for the bonus (November 30th, 1913) the Flaxmillers' Association shall appoint a committee of not less than six of its members to open and examine the applications, to test such of the competing machines or processes as it considers worthy of trial, and to make recommendations to the Government as to the payment of the bonus.

Each applicant must give, at his own expense, such reasonable demonstrations of the working of his machine or process as shall be demanded by the said committee, and such demonstrations shall take place in some convenient locality in New Zealand selected by the committee.

The Committee shall notify the Secretary of the Department of Agriculture, Commerce, and Tourists at least fourteen days beforehand of the time and place appointed for such demonstrations, and shall allow any accredited representative of the Department to fully examine the working of the machines or processes that are being demonstrated.

It should be noted that nothing in these conditions prevents a machine or process placed on the market prior to November 30th, 1913, from competing for the bonus.

On completion of all the demonstrations it deems necessary, the committee shall consider the whole of the machines or processes submitted for competition for the bonus, and in doing so shall take the following matters in connection with each one into consideration:

1. The amount of the lump sum or royalty required for the rights.
2. The cost of purchasing, installing, and operating.
3. The labor and time occupied in operating.
4. The labor and time required after the operation and before the product is ready for packing.
5. The cost of producing the fiber, tow, or other product.
6. In the case of machines or processes for extracting and dressing the fiber, the percentage of fiber, and tow if any, produced from a given weight of green leaves.
7. In the case of machines, the simplicity, durability, and safety of the working parts.

After considering the whole of the applications in the above respects, the committee shall forthwith submit to the Honorable Minister of Agriculture a report showing—

1. A complete list of all the applications received, giving the name and address of the applicant; the nature and purpose of the machine or process; the nature and value of the product; the quantity produced; the lump sum or royalty required for the rights; the estimated cost of purchasing, installing, and operating; the estimated labor and time occupied in operating; the estimated labor and time required after the operation and before the product is ready for packing; the estimated cost of producing the fiber, tow, or other product; the percentage of fiber, and tow, if any, from a given weight of green leaves; and, lastly, the simplicity, durability, and safety of the working parts.
2. Whether they consider any machine or process worthy of the whole bonus, and, if so, which one.
3. If they do not consider any machine or process worthy of the whole bonus, then whether they consider any machines or processes entitled to a part thereof, and, if so, which ones and how much.

For the information of persons who are interested in the above announcement, but who have little or no knowledge in regard to New Zealand hemp (or, as it is often called, New Zealand flax), it may be pointed out that *Phormium tenax* is entirely different from any other hemp or flax-plant. The leaves from which the fiber has to be extracted are sword-shaped, and about four to nine feet long; they are moderately pliable, and of great tensile strength. The fiber is embedded in tough vegetable-matter containing a gum and a staining substance, and the greatest difficulty in the process of extraction is the removal of the vegetable refuse, gum, and dye without damaging or staining the fiber.

Specimens of New Zealand hemp (*Phormium tenax*) can be seen in many botanical gardens all over the world.

It would be of little use to send samples of the leaves outside New Zealand, as when cut they soon wither and become stiff and brown, and altogether useless for treatment by any known process.

THOMAS MACKENZIE,
Minister of Agriculture.

Department of Agriculture, Commerce, and Tourists,
Wellington, New Zealand, September 22nd, 1911.

Notes for Inventors

A Change Making Machine.—This machine has holders for stacks of coins, and an electric motor which reciprocates a carriage to which fingers are pivoted for ejecting the lower coins from the stacks, pivoted plates lying normally in the paths of the fingers to prevent them from engaging their respective coins, electro magnetic mechanism being provided to shift any particular one of the pivoted plates out of the path of its corresponding finger to permit the last to eject a coin. The patent, No. 1,007,167, is to Everett A. Wickline of Olympia, Wash.

Baked Beans as a Hair Tonic.—We have always understood that, as a diet, pork and beans was "filling" but it remained for a California inventor, Thomas H. Bartlett, to find out a few years ago, that it had the property of "filling" the hair into the head and to cause that already in place to "stick to" its support. In his patent, No. 920,902, Mr. Bartlett describes his hair tonic as consisting of pork fat, bean oil and other specified ingredients, and describes with great particularity the cooking of a very nice edible dish of baked beans preparatory to completing the tonic. Thus in the description forming part of his patent he says: "I take three cups of common white beans and three pounds of salt pork. The beans are par-boiled, and then boiled with the pork for eight hours, and then covered tight and baked for twelve hours." With brown bread that would make a pretty good Saturday night tea in Boston.

An Umbrella Useful with Big Hats.—An umbrella that should be popular with the ladies wearing large hats is shown in a patent, No. 1,008,456, to Leo C. Bair, of York, Pa. The stick or staff is in sections which include parallel links so arranged that while the handle portion of the staff may extend up in front of a big hat, the links will extend back over the hat so that the center of the canopy of the umbrella or parasol will be about over the center of the hat, although the parallel links may be adjusted into alinement with the rest of the staff.

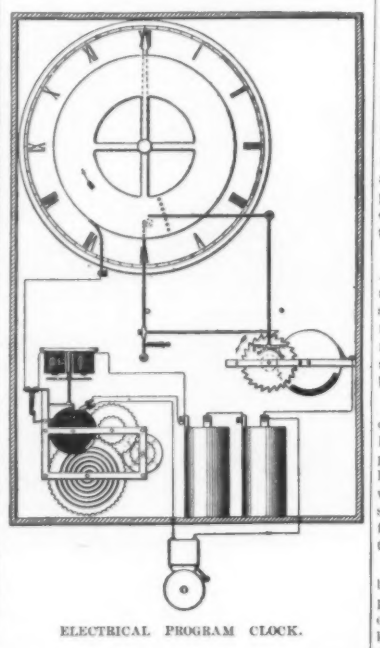
RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Electrical Devices.

SELF-SWITCHING ALARM.—B. UHLMANN, 72 Plainderville Avenue, Garfield, N. J. This invention relates to burglar alarms for doors and the like, and its object is to provide a new and improved self-switching alarm, arranged to sound an alarm on retracting the key-controlled locking bolt of the door lock, and adopted to be normally held in a set position to permit of opening and closing the door, say during the day, without ringing the alarm.

ELECTRICAL PROGRAM CLOCK.—GOTTLIEB P. MILDE, Sweet Home, Ore. This invention relates to time-controlled electric alarms for periodically sounding alarms, and its object is to provide a new program clock for use in schools, railroad stations, hotels and other places, and arranged to periodically sound alarms, to economize in battery power, and to provide a mechanism of comparatively few

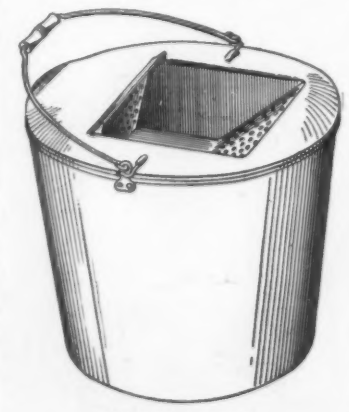


ELECTRICAL PROGRAM CLOCK.

parts not liable easily to get out of order and not requiring delicate adjustment of the parts. Use is made of an actuating and contact-making number turning in unison with the minute hand of the clock and controlling periodically another contact-making member for closing a circuit to sound an alarm. The illustration is a face view of the clock.

Of Interest to Farmers.

MILK PAIL COVER.—W. R. BUTNER, Topaz, Cal. As soon as milk reaches the lowermost row of holes after a little has accumulated in the cup it is drained off from its upper surface and trickles through into the pail body, gradually filling the latter. Any dirt in the cup cannot get into the pail, being retained in the cup, as it cannot pass readily through the holes. If the dirt happens to be of the kind which



MILK PAIL COVER.

readily sinks into the milk, it will drop into the bottom of the cup and there remain. The cover can be disengaged and lifted gradually to different angles, thus draining the milk out of the cup and leaving the dirt therein. This requires but little practice. The invention is shown herewith as applied to the pail. The cover may be made of metal and of proper proportions to fit the standard pail.

STEERING DEVICE FOR TRACTION ENGINES.—W. D. MILLER, care of Saco Mercantile Co., Saco, Mont. In the present invention the improvement relates to traction engines and similar machines used for drawing gang plows over a field, and the object is to provide a new steering device for such machines, whereby the machine is automatically guided across the field in a straight line.

Hardware and Tools.

WRENCH.—C. G. YOUNGQUIST and C. F. YOUNGQUIST, 205½ Washington Street, Portland, Ore. This improvement pertains to wrenches, and it has for its object to provide one having an eccentric journaled to a movable jaw, with a worm mounted to rotate on the eccentric, so that by rotating the eccentric the worm may be moved into or out of engagement with the rack teeth on the shank of the teeth.

SELF HEATING SOLDERING IRON.—A. J. WHITBECK, New Britain, Conn. The object of this inventor is to provide a soldering iron having an improved construction and arrangement of the burner and means whereby the preliminary heating of the same is accomplished. A number of heads of different sizes and shapes are provided and they may be used interchangeably so that the tool may be instantly adapted to the character of the particular work to be done.

PIPE WRENCH.—W. L. BESSOLO, P. O. Box K, Spring Valley, Ill. This invention comprises among other parts a handle and a jaw pivotally connected therewith to permit a limited oscillating movement of either, the former having a shoulder to limit its movement in relation to the latter in one direction, and a forward projection protruding above a pivot of the jaw to limit its movement in the opposite direction. It is simple in construction, economical in cost and efficient in use.

DIE HOLDER.—J. W. CLARK, 707 Ashland Avenue, Muncie, Ind. This invention provides a simple but powerful device for clamping a die, so that it will be held positively against movement in any direction, and wherein the holding means may be firmly locked in clamping position, without possibility of accidental release by any means.

ASH SIFTING SHOVEL.—C. F. HOFFMAN, care of Tuttle, McArthur & Dunnebacke, 501 Hollister Building, Lansing, Mich. Among the principal objects which the present invention has in view are: to provide an apparatus wherein the ash and partly burned coal are separated in the shovel; and to provide means for lifting the shifting device above the bottom of the shovel during sifting.

WRENCH.—F. C. BOTWRIGHT, 1825 Bainbridge Street, Philadelphia, Pa. This improvement pertains to wrenches, and has reference more particularly to a device of this kind, comprising a pair of relatively movable jaws, means for adjusting the same, and means whereby the jaws are released from engagement with an object between them when the wrench is turned in one direction.

PNEUMATIC HAMMER.—V. E. LANE, 150 South Portland Avenue, Brooklyn, N. Y. Mr. Lane's invention relates to pneumatic hammers, and has for its object to provide a detachable nose piece carrying the rivet set, or equivalent tool, and so arranged that the nose piece, when removed from the barrel, carries with it the rivet set, while the last is in turn detachable from the nose piece independently of whether the latter be mounted upon the barrel or not.

WIRE STRETCHER AND SPLICER.—M. W. CORNETT, Miami, Texas. This invention is for use on fence wire or for tying wire around bales and the like. Use is made of a handled winding shaft, having an eye and an arm, in which the winding shaft is mounted to turn, the arm having at its free end a hook for engagement with a loop on one end of a wire when splicing two wires, or for engagement with a fence post when stretching a wire.

SAFETY RAZOR.—A. ZILBERSHER, 1186 Madison Avenue, New York, N. Y. The invention refers to a new and useful improvement in the art of safety razors and more particularly the invention involves a retainer or cap plate used on safety razors, the construction of which especially adapts it for use with blades which have been worn down more or less after honing or stropping.

SHADE ROLLER.—C. K. SNAVELY, 178 Washington Street, Bloomfield, N. J. The aim of this inventor is to provide a roller arranged to insure an easy and smooth running of the roller for winding up and unwinding the shade cloth, to securely lock the roller in stopping position and to permit convenient assembling of the parts and securely holding the same in position.

CURTAIN STRETCHER.—J. O. HOLMQUIST, 3318 Greenwood Terrace, Chicago, Ill. This invention relates to stretchers for curtains and analogous articles, and refers more particularly to a device of this class which comprises a frame including jointed bars, a brace member movably associated with these bars, and means whereby the bars, when extended, are constrained to assume positions at right angles with respect to the brace member.

SASH FASTENER.—I. G. FRENCH, 24 Winter Street, Orange, Mass. The object here is to provide a fastener which can be manufactured inexpensively from any suitable material, such as cast metal, which can be

manipulated without difficulty, by means of which the window sashes can be securely locked against accident or unauthorized opening, and which automatically locks when the window is closed.

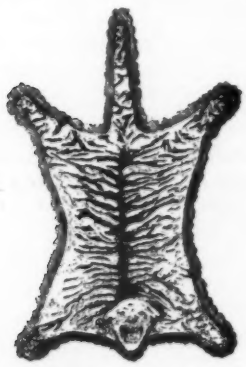
Heating and Lighting.

BURNER.—L. M. HASBROUCK, care of Continental Hotel, Broadway and 20th Street, New York, N. Y. An object of this invention is to provide a form of burner adapted more especially for use in an oil lamp, so constructed and arranged that cold air is supplied to not only the bottom part of the incandescent mantle, but is also supplied to the unburned carbonized gas at the upper portion of the mantle.

OIL BURNER.—W. Mc K. BURNS, 228 East 13th Street, Concordia, and R. W. BURNS, Cherryvale, Kan. The object in this case is to provide a burner adapted to use oil as fuel for heating. The burner has a combustion chamber adapted to receive oil therein, the oil being ignited and diffused in a manner adapted to generate heat suitable for various purposes. It is particularly adapted for cooking or for heating rooms.

Household Utilities.

IMITATION FUR RUG.—S. E. CREASEY, Alfred, Maine. The accompanying engraving gives a view of a rug constructed and arranged in accordance with the invention of Mr. Creasey. Among the principal objects which the inventor has in view are: To provide an artificial rug imitating in color, form and nap an animal's skin, trimmed, orna-



IMITATION FUR RUG.

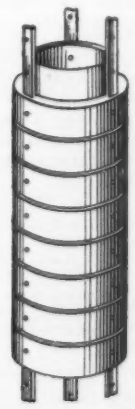
mented and arranged in simulation of rugs formed from natural skins, and to produce an article which is economical and durable. Where the rug is to be used as a floor piece, and where further illusion is desired, the head is mounted, a papier-mâché or other suitable cranium being provided. This cranium is provided with teeth and eyes, as in rugs of ordinary constructions.

GAS LOG REST.—E. S. ALLEN, 517 West 134th Street, New York, N. Y. This improvement pertains to log rests used in fire places and the like, the more particular purpose being to provide a type of log rest suitable for use in connection with gaseous fuel, and having a so-called "knock-down" construction whereby the rest may be readily folded and unfolded for convenience in packing and shipping.

SIPHON FLUSHING APPARATUS.—J. J. MEYER, 366 Lenox Avenue, New York, N. Y. The aim in this case is to provide a siphon flushing apparatus for flushing tanks, arranged to insure the emptying of the water of the tank from above the level of the water in the tank, and dispensing with submerged valves, thus completely avoiding all leakage and waste.

Of General Interest.

WELL CASING.—B. U. HIESTER, Grand Ridge, Ill. The accompanying engraving shows



WELL CASING.

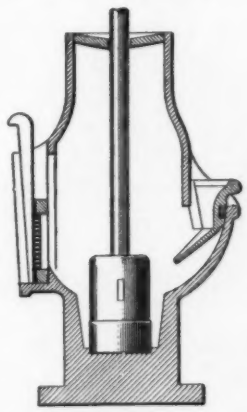
a perspective view of a number of units secured together in one manner. The invention relates generally to well casings, and more particularly it is directed to an improved means for holding together the units described and claimed in Letters Patent No. 1,001,523, granted to Mr. Hiester. The aim of this inventor is to provide a means for securing in operative position a number of well casing units set forth in the above application, the said securing means being preferably vertically extending rods which may occupy a variety of positions with respect to the units.

DISPLAY DEVICE.—W. WELLER, Bonduel, Wis. This invention refers generally to devices which are adapted for use in displaying articles of furniture and more particularly it involves one especially intended to co-operate with the parts of a bed in order that the parts may be held in upright position and convenient for inspection.

SHIP OR VESSEL.—G. E. ELIA, Hotel de Crillon, Place de la Concorde, Paris, France. This invention relates to ships or vessels and is particularly applicable for use in connection with vessels employed in naval warfare, the object being to preserve the stability of the same in the event of their being subjected to the effects of a submarine explosion.

METAL SPRING.—L. L. B. DENIS, 135 Boulevard de Ménilmontaut, Paris, France. In this invention the spring is formed from wire or metal rod of any convenient cross section bent on a flat or conical surface to form the outline of a conventional star, the radiating arms of which are subjected to torsional stresses when the exterior and interior supporting planes are moving together or apart.

STAMP MILL SCREEN.—D. C. EN EARL, Rollinsville, Colo. This invention consists of a screen to be used in the mortar of a stamp mill employed for the wet crushing of the ores of gold and other precious metals. The screen is shown in position in place on the mortar of the mill. The invention consists broadly in the number of bars arranged adjacent one another but spaced apart so as to provide openings therethrough, which openings gradually in-



STAMP MILL SCREEN.

crease in size to prevent the screen from becoming choked as the crushed ore is washed therethrough. The screen sifts the ore after it has been crushed and delivers it to the amalgamating plate or table in a sufficiently powdered condition to insure retention by the quicksilver with which the plate is covered.

PROTRACTOR.—J. GOODFELLOW, Cheever, N. H. This invention relates to a protractor of the type in which the various angles are designated on an arcuate periphery, whereby they may be transferred to any suitable work, and which is further provided with a supplementary arc or curve for determining various points and aiding in the solution of various geometrical problems.

DAM.—J. C. WHEELON, Garland, Utah. The invention relates to hydraulic engineering, and its purpose is to provide a dam having a collapsible crest, which can be raised or lowered at will to permit flood waters to be safely discharged over the dam with the utmost safety to the dam and all the head works and controlling works connected with the waterway.

GLUE MELTING PROCESS.—C. M. ZIMMERMAN, 221 West Third Street, Cincinnati, Ohio. In operation a converter is placed within the soaking tank and the glue put into the converter, and as much water afterward added as the glue can take up in passing into a jelly form. The vessel is then seated within the melting apparatus, where the glue is rapidly melted, and drips through the perforated bottom of the converter into the collector and then runs out through the discharge pipes; thus soaking and melting are performed without transferring glue from one vessel to another.

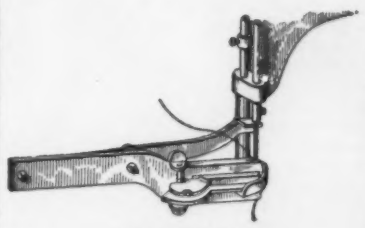
SAMPLE BOOK.—C. GREEN, 394 Canal Street, New York, N. Y. This invention relates to a sample book which is adapted to display textile fabric, wall paper or the like of various colors and qualities, both in their flat, smooth condition and in a ruffled or rumpled condition, and in full yard length, so that every possible characteristic may be exhibited.

FIRE EXTINGUISHER.—C. H. DRISCOLL, care of U. S. Smelting Co., Midvale, Utah. This extinguisher is arranged to utilize the tank containing the solution and the acid receptacle as a reel for the hose, the nozzle of which normally engages a lock for holding the reel against rotation, whereby the acid bottle is held suspended in the tank until the latter is unlocked or removal of the hose and the tank is rotated on unwinding the hose.

DEPTH GAGE.—F. I. WALKER, Babylon, L. I., N. Y. In this gage the keepers are set back a substantial distance inward from the working edges of the head, and the metal at these edges brought well to the blade so that the head gage will rest evenly substantially throughout on the surface, to which it is presented, and will not be raised therefrom when the head is laterally tilted.

Machines and Mechanical Devices.

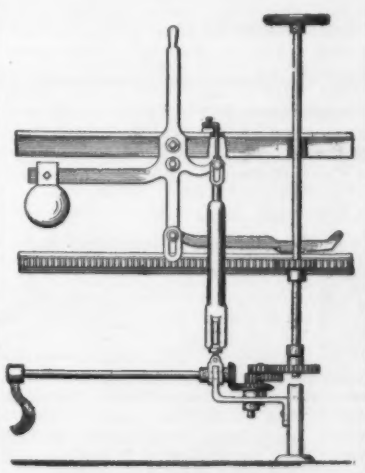
NEEDLE THREADER.—W. J. ROGERS, Box 567, 307 Madison Avenue, Plainfield, N. J. In this invention the improvement relates to needle threaders, and it has for its object to provide one having a handle, with a guideway in which a member carrying a plunger is adapted to travel, a member carrying a thread catcher being pivoted to the handle, and hav-



NEEDLE THREADER.

ing means for reciprocating the member carrying the plunger. Another object is to provide a spacing arm adjustably mounted on the handle adapted to abut against the bottom of a needle bar for holding the plunger in alinement with the eye of a needle. The view shown in the engraving gives the invention in position for service.

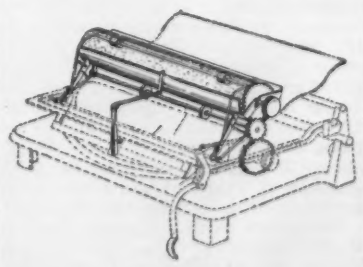
SLUBBING OR ROVING FRAME.—J. D. IRVING, 514 Edgmont Avenue, Chester, Pa. The engraving herewith shows a side elevation of a roving frame provided with auxiliary controlling mechanism, parts being shown in section. The invention relates to spinning, and its purpose is to provide improvements in frames whereby the operator is enabled to quickly regulate the tension of the roving or



SLUBBING OR ROVING FRAME.

slubbing without knocking off and stopping the machine or without danger of injury to the hands. For this purpose use is made of an auxiliary tension regulating mechanism, controlled by the operator and connected with the cross shaft, the mechanism extending to the front of the roller beam to be within convenient reach of the operator, to enable him to swing the shaft out or into gear.

COPY HOLDER.—H. UTSCH, Little Falls, Minn. The object of the invention shown in the engraving is to provide a simple, economical and easily operated device which may be readily applied to and detached from a typewriter carriage, and which will travel with the carriage, will advance the copy synchron-



COPY HOLDER.

ously with the advancement of the writing paper, and wherein the indicator of the typewriter carries the indicator of the copy holder, so that the two indicators always indicate on the copy that portion of the one that corresponds to the same portion of the other. The illustration represents the improvement in place on a typewriter.

Prime Movers and Their Accessories.

ROTARY ENGINE.—G. T. CUNNINGHAM, 1049 Margaret Street, Shreveport, La. The object of the improvement is to provide an engine wherein oppositely arranged blades are provided and wherein the motive fluid is permitted to act upon the blades during 180 degrees of their travel before exhausting, together with a simple and easily adjustable operating mechanism.

CARBURETER.—M. WEIWODA, care of Atlantic Yacht Club, Sea Gate, Coney Island, New York, N. Y. This invention has reference to certain improvements in carbureters for forming explosive mixture, and more particularly to that type of carbureter in which a liquid fuel is used and which is vaporized and mixed with air or other oxygen-bearing gas.

CYLINDER AND WATER JACKET FOR INTERNAL COMBUSTION ENGINES.—I. CRABB, West Union, Iowa. This invention provides a jacket constructed and arranged in such manner as to avoid breakage or other damage usually sustained by closed and rigid water jacket constructions caused by the expansion of the water contained therein when formed into ice; and provides a jacket to permit the rapid and easy separation of the same for repair or renewal.

Railways and Their Accessories.

AUTOMATIC COUPLING.—H. C. NEWMAN, 1120 E. Madison Street, Portland, Ore. This invention relates to couplers for train pipes of air-brake systems, signal pipes, and steam pipes of railroad trains, and refers more particularly to a device of this class, comprising heads adapted to be arranged in juxtaposition to effect the operative connection of the pipes which are associated with the heads, one of the pipes associated with each head forming a supporting means therefor, in combination with means controlled by the movement of the last-mentioned pipe, for operating the valves of the various pipes.

MAIL CRANE.—F. HANSEN, Woodbine, Iowa. This invention has reference to mail-bag delivery, and its object is the provision of a new and improved mail crane arranged to properly support the mail bag, for accurate engagement by the catcher, with a view to unfailingly deliver the mail bag to the mail car.

Pertaining to Recreation.

TOY GUN.—F. A. KOPP, Miami, Fla. This improvement relates to a gun which is made up of a frame member having a resilient band carried thereby, together with means for holding the band in stretched position, and other means for releasing the band whereby the end of the band when released may be caused to strike some object, such as a fly or an insect.

Pertaining to Vehicles.

COMBINED STEERING AND DRIVING MECHANISM.—S. E. SIDERS and G. A. SIDERS, Delphos, Kan. This invention relates to motor vehicles, and particularly to the means for driving and steering the forward wheels thereof. The object is to provide a motor vehicle with front steering wheels, and with means for transmitting power to said wheels without interfering with their steering action. It provides gearing for motor vehicle wheels, which will drive and steer the same.

RESILIENT METALLIC VEHICLE WHEEL.—W. H. WALES, Jr., care of Atlantic Creosoting and Wood Preserving Co., Norfolk, Va. The purpose of this invention is to provide a vehicle wheel tire composed mainly of resilient metal, which is constructed having co-operative elements, which are so combined that equal support and resilience under load-strain, are afforded for all parts of the wheel.

WAGON.—T. B. MASON, 209 Warren Street, Trenton, N. J. This invention relates to wagons for carrying ashes, garbage or other refuse, and refers more particularly to a wagon comprising a body adapted to hold the material, a movable material-receiving member having a normal position wherein it discharges into said body and forms a closure therefor, and means for operating the member.

Designs.

DESIGN FOR OPEN MESH FABRIC.—A. G. JENNINGS, care of Jennings Lace Works, Park Avenue, Brooklyn, New York, N. Y. This ornamental design comprises open mesh work of pear-shaped design, the rows of which alternate so that the points and heads of the pear-shaped patterns are reversed. The design is original and the effect attractive. Mr. Jennings has also designed an ornamental Face Veil with two border bands of slightly different widths, the bands slightly separated. The interior space comprises an ornamental field of lace-work of a beautiful pattern.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Technique of Clam Digging

IN our issue of December 16th, on page 564, we published a letter from Mr. Hugh N. Johnson criticising our advertisement headed the "Technique of Clam Digging." The advertisement referred to appeared in the same issue on page 566. Our reply to Mr. Johnson's letter, which was inadvertently omitted last week, is as follows:

Your criticism of "The Technique of Clam Digging" is just—from the viewpoint of the Pacific Coast and some parts of the Atlantic Coast.

The species of *Tapes* and *Saxidomus* which flourish on the Pacific coast, and the *Mya Arenaria*, which multiplies in long-armed softness on the north Atlantic coast, are harvested with a fork and bucket at low tide.

Plainly the writer of the advertisement had in mind only the *Venus Mercenaria*, which, despite its suggestive name, is the aristocrat of the clam family, the only one having real gastronomic distinction. It is true, the soft, long-fingered clam dug out of the mud appeals to many tastes when steamed and that it is also used sometimes for chowder, but it never ventures to raise its long, humble neck in the presence of its relative, the little neck.

With the assumption of superiority familiar in the New Yorker—anybody who manages to exist in the metropolis for six months calls himself a New Yorker—the writer of the advertisement calmly took for granted that the only clam worth talking about is the lordly *Venus Mercenaria*. In New York it is "the clam"—the long-necked variety being invariably designated as "the soft clam."

And the *Venus Mercenaria* or hard clam, or little neck, or quahog, is harvested exactly as described in the advertisement.

The mistake the writer of the advertisement made was in assuming that this clam, more or less local to a small part of the seaboard, is the only clam. He is a victim of insular prejudice rather than of ignorance.—EDITOR.

A Mechanical Evolution and Smokeless Cities

To the Editor of SCIENTIFIC AMERICAN:

No smoke on our rivers, no smoke on our lakes, no smoke from our factories, in fact smokeless cities, is the immediate boon in store for us through the most meritorious invention of the compressed-air internal-combustion engine.* Before briefly describing the principle of this beautifully simple motor, it may be well to give a short *résumé* of the development of the marine engine. The oldest marine engine and boilers I ever had charge of were fitted in the steamer "Windermere" by John Penn & Sons of Greenwich in the year 1857. It was in this vessel that the first surface condenser, that most important of all adjuncts to the marine engine for salt-water service, was fitted by Samuel Hall. The working pressure of steam was but 15 pounds per square inch, speed of piston slightly below 200 feet per minute, and the combined weight of engines, condenser, pumps, boilers and water therein equaled one gross ton for each indicated horse-power.

Now the reduction of weight for power developed is the great desideratum for marine propulsion at least, and this is certainly true as regards propulsion in air. The reduction of weight for a given power is most largely due to augmented piston speeds. This speed has advanced during half a century from 200 feet to 1,000 feet a minute for reciprocating engines, and to 20,000 feet in rotary engines. The other factors contributing to efficiency are higher steam pressures, greater vacuum, and stronger materials.

Though the continuous development of the tri-compound and quadruple-expansion engines was inaugurated by the construction of the "Aberdeen," built in the year 1882 by R. Napier & Sons, the first triple-expansion engines were fitted in the "Propontis" by John Elder & Co., in 1874, their dimensions being 23 + 41 + 62 × 42 inches. The combination in this vessel delayed the advancement of the triple or multiple expansion system solely through the failure of the Rowan boilers. This, however, is no exception to the rule; the boilers have always been the troublesome and expensive element of marine propulsion, and their elimination will tend wonderfully to simplify the work and responsibility in the engine room.

Fifty years ago the average consumption of fuel was about 5 pounds per indicated horse-power per hour. To-day this consumption is reduced to one-half pound of fuel per horse-power hour. The following table shows in chronological order over half a century:

The Reduction of Fuel Consumption per Horse-Power Hour.

	Fuel Consumption, Pounds.
1850. Steam pressures 15 pounds	5
1860. Steam pressures 25 pounds with surface condensation	3
1870. Compound engines	2¼
1880. Triple-expansion	1¾
1890. Quadruple-expansion (increased pressure)	1¼
1901. Internal-combustion engine	½

As it may appear somewhat remarkable, I may point out here that the consumption of crude oil fuel works out about the same, whether it be used explosively or to generate steam. The space which could be saved for the accommodation of passengers and cargo in a 20-knot steamer by substituting the compressed-air, crude-oil, internal-combustion engines for the familiar steam engine or turbine instalment, measures fully 5,000 cargo tons. Now I venture to assert that the greatest mechanical invention since Samuel Hall invented the surface condenser, or probably since Watt devised the steam engine, is now afloat on our Great Lakes, and is being duplicated in that locality for coast service. This is the Diesel improved internal-combustion motor or engine. As this engine is beautifully simple and works with crude petroleum, of course without steam, it seems destined to quickly displace the steam turbine, and with it, the use of coal and steam, for propulsion at least, will no longer be required. An engineer cannot witness the retirement of those good and faithful old servants without feelings of regret, especially since the advent, on a magnificent scale, of the steam turbine was so recent; still, it seems quite apparent that their day of usefulness is almost over. The adoption of the steam turbine was too long delayed to admit of a long lease of life, the principle of the De Laval impulse turbine having been clearly illustrated more than two thousand years ago. The internal-combustion engine of to-day does not weigh more than one-fifth of that of a marine engine and boilers of equal power; and when it is considered that there are gasoline engines on the market weighing not more than 2½ pounds a horse-power, who shall say that instead of being below one-fifth of the weight of the steam engine and boiler, the crude oil combustion motor may not be reduced to one-tenth or less of the weight of the steam boiler and engine instalment?

To me it appears that the sterling merit of this new invention is the beautifully simple means of firing the charge. Instead of the fickle and complicated electric spark system, the crude oil is ignited by a sudden and high degree of air compression within the cylinders. This device is not only reliable, but is very simple, which is of the utmost value for marine propulsion at least.

Consider a steamer with large boilers, coal bunkers, coal chutes, coaling hatches, and all the paraphernalia for operating, cleaning, and repairing, and then try to imagine all of this weight and complication absolutely eliminated, and a space six times as large as the engine room thrown open for the stowage of cargo or the accommodation of passengers. Well, this is just what the adoption of the

*The invention of Dr. Diesel.

crude-oil motor will accomplish. Bearing this in mind, and with many concrete examples of this great transformation in evidence all the world over, I may venture to predict that no marine boilers and steam engines, for the propulsion of ships, at least, will be seen anywhere under construction, after the Panama canal has experienced five years' service.

Chicago, Ill. JOSEPH R. OLDHAM.

A Fatal Omission

To the Editor of SCIENTIFIC AMERICAN:

I want to compliment you on your editorial under the heading of "A Fatal Omission." I have no interest whatever in the Pennsylvania Railroad, but I do feel a most serious blunder has been made by New York city in not arranging subway connection with their new station. I would like to see the press unitedly agitate the matter so that the convenience might be speedily brought about, and the general public receive a benefit that they are entitled to. When we consider that ten million passengers were carried through the station the first year of its existence, it is a disgrace to the city that an immediate effort for relief is not put under way.

W. F. HARTRANFT.
Jersey City Heights, N. J.

The Current Supplement

THE front page article of the current issue, No. 1877, of our SUPPLEMENT, is devoted to an illustrated description of the 3,000-horse-power Hydros Electric Power Plant at Cannon Falls, Minnesota.—Prof. Woodworth's article on the Psychology of Light reaches its second installment.—Frémont's new test for steel rails, which promises to become a standard method, is described.—An article by P. V. Vernon deals with the influence of composition and previous history of steel on the power required to cut it.—An article on "Developing a Small Water Power Plant" should prove of special interest to farmers and others located at a distance from city centers.—G. C. Sawyers, cheese expert, writes on the "Manufacture of Cheddar Cheese."—At the opening of the winter season an article on "Skis, Their Construction and Use," will be welcomed by many of our readers.—A very scholarly account of "Wheels, Ancient and Modern," from the times of primitive man to the day of the steel-spoke automobile, is given by H. L. Heathcote.—Condiments and Stimulants have their use, as well as abuse. They are discussed from a scientific standpoint in an article derived from *Prometheus*.

World's Oldest Liqueur Distillery

(*Concluded from page 577.*)

cipe to his successor, who would also be oath bound.

And so operations continued in the first monastery for nearly six centuries, when the order built another plant near Fourvoirie, the supply of raw material at the original location being exhausted. The new plant was strictly ecclesiastical in architecture and cost nearly 5,000,000 francs—all paid out of income from the sale of chartreuse to the monastic orders in France, for until fifty years ago it was not drank by anyone except the French monks. It was regarded as a sacred beverage, and to sell it outside of the church was sacrilege. The mystery of chartreuse making and its peculiar taste were two of the reasons for its popularity, which was so great, once it had come into public use, that it was soon shipped, in kegs, all over Europe, to be bottled and sold by the bottle or glass in the cafés. When the Fourvoirie plant was working to its full capacity the output was 15,000,000 gallons a year.

In making the cordial, the monks gathered the dozen different species of herbs which were required to give the right blend. These were first thoroughly dried, in the storehouse, being spread out on the floor, and exposed to air currents. The different herbs were then placed in spring water in separate vats, which were heated by wood fires—this for extracting the juice. The tanks were covered and the steeping process occupied about twenty-four hours, when the juice was drained off through pipes in the lower parts of the cooling vats. Next the liquid was distilled, the process being quite similar to the distillation of whiskey.

"Made in Germany"

Schulz made typewriter ribbons in a factory near Berlin. But he couldn't make them quite as good as the imported American ribbons. At least, he found that stationers and office supply dealers sold more American ribbons than they did of his, even though his ribbons were cheaper.

"There must be some reason," said Schulz, "why Germans are willing to pay more for American ribbons. I must find out why."

Did he engage a chemist? Did he snoop around in American ribbon factories, trying to find out how ribbons are made in America? Did he bribe workmen to reveal a precious trade secret?

No.

Schulz simply sent a few American ribbons and some of his own ribbons to the Koenigliches Material-Pruefungsamt – the Royal Laboratory for Testing Materials. In a few weeks he received a report in which he was told that the life of an American ribbon was twice as long as his own, that the fabric of the American ribbon was composed of this and that material and had a tensile strength three times as great as Schulz's, that the ink of the American ribbon was composed of such and such chemicals and pigments, with the result that its record was legible for a longer time and absolutely light-proof.

This is the kind of work that the Koenigliches Material-Pruefungsamt does for any German manufacturer. It gives expert information to him who is entitled to it, and at a price that doesn't begin to pay for the elaborate scientific investigation involved. Whether it be a girder for a bridge, or a button for milady's shoe, that public laboratory tests anything, and tells the German what he must do to make it better and cheaper, if possible.

In the next number of the Scientific American we will publish an article by Mr. Waldemar Kaempffert, Managing Editor of the Scientific American, on this remarkable institution.

We sent Mr. Kaempffert to Europe in order to study the part that science plays in German business and public affairs. His article on the Koenigliches Material-Pruefangsamt will be the first of a series in which new phases of German science and commerce and education will be revealed.

After you have read the series you will feel that "Made in Germany" means a good deal more than mere cheapness; that there may be far more science in the cheap German penknife bought on the street corner than you may suspect; that science, and not simply cheap labor, has made Germany a great commercial nation, and the German city the best-governed municipality in the world.

Watch the Scientific American advertising pages for announcements of the articles still to appear.

Then came the blending of the different extracts into the secret composition that has given chartreuse the flavor and the exhilarating effect which has made it famous. This, the most delicate process, was supervised by the director; and before it was performed, mass was observed to sanctify the product.

It is not generally known that three forms of the liqueur were manufactured at the chartreuse establishment; the green and the yellow chartreuse all know, but there is a much weaker extract, the white chartreuse, which was drunk with water by all the employees of the monastery, and was given to the stranger who accepted the hospitality of La Grande Chartreuse for a meal.

Until seven years ago the Carthusians kept up their industry. They also worked farms; built schools and churches for the peasants; and laid out some of the finest roadways in Europe. In 1904 the French government seized their property, forced out the Carthusians and since then have been making the liqueur—but it is merely a poor imitation of the brew prepared by the monks.

NEW BOOKS, ETC.

THE COPPER HANDBOOK. 1910-1911. Vol. X. Compiled and published by Horace J. Stevens. Houghton, Michigan. 8vo.; 1902 pp.

In "The Copper Handbook" we find a vast amount of information, both historical and timely. Copper in its geological, chemical, and mineralogical aspects; its mining, milling, and concentrating; its hydrometallurgy, pyrometallurgy, and electrometallurgy; its alloys; the various grades, uses, and substitutes; a glossary of mining terms; chapters on the copper deposits of the Americas, of Europe, Africa, Asia, and Australia; a section of reliable and valuable statistics—in a word, we have a handbook crammed with facts pertaining to copper in its relation to industry, and to the industries. Three-fourths of the space is taken up by an alphabetical presentment of the copper mines of the world, their location, date of organization, capitalization, a description of shafts and levels, the nature and extent of deposits and present condition of activity—many being characterized as "idle for years," "idle and apparently moribund," and "dead." There must be upward of 9,000 mines described in this section of the work.

THE ART OF LIFE. The Way to Health and Longivity. By Jogender Lal Chundra, L. M. S. Calcutta, India: Published by the Author, 5, Gopee Kristo Paul's Lane, 1911.

The spelling of the sub-title is the author's. In spite of the quaint English and fantastic spelling, Dr. Chundra's curious little work is on the whole sane and progressive. Drugs and drug treatments, while not entirely condemned, are subordinated to hygienic and dietetic principles. The papers embody, among other themes, a distinct contribution as to the value of common salt in the system; a survey of the diseases most prevalent in India, with notes on their geographical distribution and the conditions which favor them; and an incursion into so-called "personal magnetism," colored, of course, by the Oriental viewpoint and philosophy.

KING ARTHUR AND HIS KNIGHTS. An Abridgment of Le Morte d'Arthur. Edited by Henry Burrowes Lathrop. Illustrated by Reginald Birch. New York: The Baker & Taylor Company. 8vo. Price, $1.50 net.

Emphasis is laid upon the fact that this is not a series of excerpts from the original, but a careful abridgment in which the utmost has been done to retain in one volume of moderate size all the vivid coloring and incident of Malory's narrative. The story of the Morte d'Arthur is told, substantially as Malory told it, in a connected series of vital episodes that can not fail to appeal strongly to young people. Indeed, the sole purpose is to bring within the scope of youthful interest what is truthfully claimed to be the most delightful record of its kind which the English language has to offer.

ANIMAL INTELLIGENCE. Experimental Studies. By Edward L. Thorndike. New York: The Macmillian Company, 1911. 8vo.; 297 pp.; diagrams.

The author here presents in one volume a number of monographs which have been published separately and as papers in scientific periodicals. His avowed purpose is to make accessible to students of biology and psychology his own experiments in animal intellect and behavior. His research has led him to deprecate the employment of introspection as the chief method of psychology, which he prefers to regard as largely the science of behavior and a virtual extension of physiology. The experiments are primary and simple, but, like all simple things of this kind, illuminate the higher phases of being for those who are able to read their symbolism aright.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12582) E. McGee asks: Would you be so kind as to give me an explanation of a statement made by Carhart and Chute in regard to the transformation of energy. They say: "The energy of the solar system is becoming all the time less and less available." A. You omit one very important word in making your quotation from Carhart and Chute's Physics, page 77. That word is "*therefore*." The sentence as given in the book is as follows: "The energy of the solar system is therefore all the time becoming less and less available." *Therefore* refers back to what has preceded. The radiated energy of the sun and other kinetic energy, which is employed in doing work in nature or for man's needs, is *useful* energy. All else is useless, and becomes waste heat. So the authors say therefore the amount of energy which is available for useful purposes is all the time becoming less and less. It seems to be a plain statement. The sun is radiating heat all the time into space, and this heat does not, so far as we can determine, do any useful work. It reduces the available energy of the sun and is lost to us. There is less that we can have, less that is available.

(12583) R. J. M. asks: Why does silver or silverware, when placed in an aluminium vessel with boiling water, come out with a brilliant appearance as if new? Please give me the reason. A. The cleansing of silver as you describe is an electrical process. A feeble electric current is produced between the silver and the metal pan, and a new and fresh surface of the silver is exposed.

(12584) H. E. says: An argument arose regarding the following questions, and I would be pleased if you would give me some information regarding same. What is the horse-power of an engine 10×10 at 100 pounds pressure? If a suitable size low pressure be added to a 10×10 engine at 100 pounds pressure, what horse-power would it develop? A. Your question involves a large part of the theory of steam engineering. The horse-power of the engine depends upon the speed of the engine (which you do not give) as well as upon the cut-off and consequent expansion and mean effective pressure, which latter is always less than the initial or boiler pressure. If a 10×10 engine is operated at one-quarter cut-off and 100 pounds steam pressure by gage, the mean effective pressure (disregarding all losses) is $68\frac{1}{2}$ pounds above vacuum, and the pressure at the end of the stroke will be 29 pounds above vacuum. If the steam is exhausted at the above 29 pounds pressure, the horse-power of the engine will be about $15\frac{1}{2}$. If, however, this steam is now turned into a low-pressure cylinder 20 inches diameter and 10-inch stroke, an approximate horse-power of $15\frac{1}{2}$ can be developed by expanding the steam to a low terminal pressure and exhausting into a condenser. The engine has now become a compound. But the same power could be developed (theoretically) by operating the low-pressure cylinder alone at 1/16 cut-off, and omitting the high-pressure cylinder. The only advantage in using the two cylinders, that is, a compound engine, is in the improved economy due to expanding the hottest steam in a cylinder which is hotter, on the average, than the temperature of the second cylinder, in which cooler steam is worked. If an engine could be made with a single cylinder of some imaginary material without any conductivity or capacity for heating, it would do all that a compound engine could do. If a glass cylinder were possible to operate, there would be no advantage in point of economy in compound engines, as a single large cylinder of glass would do all the work of a series of two, three, or more of a heat-absorbing metal like iron, brass, and the like.

(12585) A. B. F. says: I would be pleased to know if the combination of gasoline and coal oil (as used in lamps) in a gasoline engine, will produce more power than gasoline alone. Please give B. T. U. of gasoline, also of naphtha and coal oil. A. Gasoline and kerosene have different specific gravities, and if mixed for use in an engine, gasoline will evaporate first and leave the heavier part of the coal oil for the last. The kerosene has a greater fuel value than gasoline per gallon, though very closely the same per pound. Kerosene is a cheaper fuel than gasoline, both because of its slightly greater heat value and because of its much lower cost per gallon. The fuel values of the various petroleum products, such as gasoline, benzine, kerosene, etc., are over 20,000 B. T. U. per pound, and differ little, one from the other.

ANNUAL MOTOR NUMBER

MOTOR CARS MOTOR TRUCKS MOTOR BOATS MOTOR CYCLES

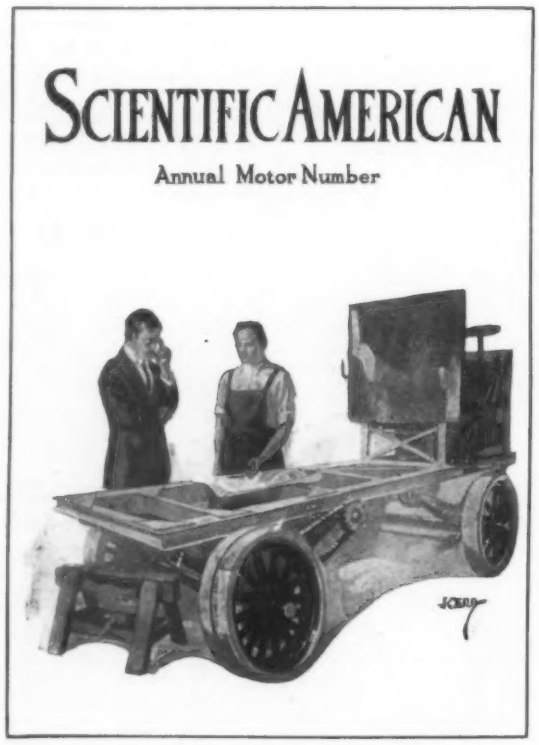
JANUARY MAGAZINE NUMBER OF THE SCIENTIFIC AMERICAN

ISSUE OF JANUARY 6, 1912

Although we are well past the dawn of the "hydrocarbon age," we have not yet reached the meridian period. Each year there are new developments making for the betterment of motor-driven land and water vehicles. The improvements that are to be brought out in 1912 are exceptionally interesting and will be outlined in detail in this number. The following articles will appear:

Selection of a Motor Truck

In what respect do leading types of motor trucks for 1912 differ mechanically? How can the owner best protect his investment? What are the costs of upkeep and operation as compared with those of horse-drawn trucks? Can truck chauffeurs be made of ordinary teamsters? These are vital questions to the intending purchaser of motor trucks, which will be ably discussed.



Will Rubber Tires be Supplanted?

While tire manufacturers are doing everything that is humanly possible with rubber and fabric, yet, undoubtedly, there is no feature of a motor car that gives the owner more concern than the tires. The ability of rubber to stand up under the terrific shocks and wearing grind of service is a marvel. Hundreds of inventors have been busy at the task for years, no substitute for the rubber tire has yet been developed to such a degree as to supplant the standard pneumatic tire. Just what has been done in the past, and what promises are held for the future, will be brought out in this article.

The New God of War—Gasoline

In this article the prominent place occupied by the automobile in European military maneuvers is described. In the United States the armored automobile has been entirely neglected. In Germany in time of war every car in the country, private as well as public, is placed at the beck and call of the Government.

Auxiliary Uses for Motor Vehicle Engines

Herein are described a number of novel uses for the engine of a motor truck or an automobile.

The Comparative Cost of Light and Heavy Cars

This question is debated by a man who has made painstaking and impartial comparison of every detail of his personal expenses in connection with two cars, one a typical light car, and the other a standard heavy car.

Making the Starting Crank Obsolete

One of the most noticeable features of the 1912 car will be the absence of a starting crank in front of the radiator. The desirability of providing a means for starting the car from the driver's seat was expressed years ago, and its necessity has been urged more clamorously each year. Now, suddenly, a score of different self-starters have been developed, and the majority of manufacturers are going to bring out their 1912 cars with some sort of a self-starting mechanism. The leading types of self-starters will be explained so that any automobile owner can understand them.

Driving the Car at Night

To obtain the full value of a motor car, it must be available for service at night as well as during the day time. There is much more to safe night-riding than a pair of powerful headlights. There are new developments which every automobilist should know.

The Easy Riding Car

The pleasure vehicle has now become so standardized that the riding qualities of an automobile receive much more attention than heretofore. As a consequence, designers have been devoting much thought to the springs, shock absorbers, upholstering, the balance and hang of the body, and all the features that enter into the making of a comfortable car. The prospective purchaser should know that the distribution of weight on a car is an important factor in making it "stick to the road." A badly-balanced car will possess poor traction qualities owing to the tendency of the rear wheels to bounce off the road's surface.

A Fertile Field for Inventors

Under this subject are detailed many ingenious devices that inventors have developed of late for use on automobiles.

Lessons in Everyday Motor Boat Designs

The racing motor boat is very properly considered a useless craft for pleasure purposes. In the present article, however, it is clearly brought out that the design of the pleasure boat has been materially improved by the development of the racer.

Motor-Cycle Developments

What is being done to improve that noisy, sputtering, two-wheeled vehicle? Among the prominent features for 1912 are footstarters, multiple jet carbureters for slower running in cities, improved mufflers, and floating seats to make riding more comfortable.

Price Fifteen Cents on All News Stands